SCIENTIFIC AMERICAN

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Vol. XCIV.—No. 5.
ESTABLISHED 1845.

NEW YORK, FEBRUARY 3, 1906.

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Fighting Dryptosaurs. Though Much Smaller in Size, These Creatures Doubtless Closely Resembled Tyrannosaurus Rex in Appearance and Habits.

CARNIVOROUS DINOSAURS OF THE AGE OF REPTILES.—[See page 113.]

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MUNN & CO., - - Editors and Proprietors

Published Weekly at

No. 361 Broadway, New York

TERMS TO SUBSCRIBERS

One copy, one year, for the United States, Canada, or Mexico $3.00
One copy, one year, to any foreign country, postage prepaid, £0 16s. 5d. 4.50

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (Established 1845) .... $3.00 a year
Scientific American Supplement (Established 1876) .... 5.00 "
American Homes and Gardens .... 3.00 "
Scientific American Export Edition (Established 1878) .... 3.00 "

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MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, FEBRUARY 3, 1906.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

A CANAL BY LAKE AND LOCKS.

There is a growing recognition, in the discussion of the Panama problem, of the advantages to be gained by impounding the rivers that intersect the line of the canal, and turning the valleys through which they flow into large inland lakes. If the line of the canal be flooded in this way, it is evident that every foot of water represents a foot less of excavation. This being the case, one might reasonably ask why the impounding dams should not be raised sufficiently high to give everywhere the required depth of 35 or 40 feet, and thus get rid of excavation altogether. Theoretically, this would be the cheapest and probably the most expeditious way; but, as every one knows, the Panama Canal is located through the lofty Culebra divide, which projects far above any possible canal-lake level, and will call for an enormous amount of excavation, even if a high-level canal be determined upon.

Admitting, then, that the Culebra excavation must ever remain the dominating element both as to time and cost of construction, and that the portion of the canal which passes through Culebra must be of the minimum width compatible with the needs of navigation, the question arises as to how far the remainder of the canal, both on the Pacific and Atlantic slopes, can be formed by the canalization of the rivers. The question is not a new one; for when De Lesseps found that, for financial reasons, he was unequal to the task of cutting through a canal at sea level, and called upon his engineers to devise an easy and economical method of getting a canal of any kind across the Isthmus, the use of impounded lakes was suggested, and plans were drawn up embodying this feature. In all the long discussion and investigation of the Panama project, the canalization of the rivers has been made the subject of occasional suggestion; but it was not until the carefully-worked-out plans which form the subject of illustration elsewhere in this issue were presented, that canalization, or the "lake-and-lock" method, was incorporated as the dominant feature.

As compared with other types of canal, whether high level with many locks, or sea level with one tidal lock, the canalization method has the great advantage that it combines economy and speed of construction with rapidity of transit for shipping when the canal is opened. The author claims that, in the present case, the time of transit would be but 8.8 hours, as compared with the 12.4 hours, which is the estimated time of transit through a sea-level canal, the saving in time being due to the greater speed that can be made by shipping in passing through the artificial lakes.

DOES A WATER FAMINE THREATEN NEW YORK CITY?

New York city possesses a population of 4,000,000 people. Of this number, 2,400,000, representing the inhabitants of Manhattan and the Bronx, are absolutely dependent upon the water that flows in a river of very modest proportions situated about forty miles to the north of the city. Every drop of water that we draw from our faucets has to be taken from the natural flow of this river. The amount of this flow varies greatly in different months of the year, and there is also a great variation in the average annual flow. It has fallen as low as 30,000,000 gallons per day, which it did in the month of October, 1880, and it has risen as high as 956,000,000 gallons per day, which happened in February, 1881. At the present time, the city is consuming on an average 300,000,000 gallons per day.

If the point of intake of the aqueduct which conveys the water to the city were located immediately in the bed of the river, and were so placed that, when the aqueduct was running full, the surplus water of the river would flow past it and empty into the Hudson, it is evident that the city would have all the water it needed just as long as the flow of the river was 300,000,000 gallons per day. If that flow were to fall below this amount, say to 250,000,000 gallons per day, then that would be the amount of water that the city would receive, and there would be a shortage of exactly 50,000,000 gallons per day. Now, in the four months of October, November, December, and January of 1880 to 1881, the average daily flow was respectively 30,000,000 gallons, 94,000,000 gallons, 72,000,000 gallons, and 100,000,000 gallons; so that if a similar dry season were to visit this section of the country, and if there were no storage reservoirs, and the intake of the Croton aqueduct were simply placed in the bed of the river, there would be in those four months an average daily shortage respectively of 270,000,000 gallons, 206,000,000 gallons, 228,000,000 gallons, and 150,000,000 gallons.

The object of the great and costly dams, which have been built across the various valleys of the Croton watershed, is to catch all the surplus water, which flows in the river during the heavy rainstorms and during months of large precipitation, and hold it back for use in the dry months, when the flow of the river is small. At the time of the building of the Croton reservoir, it was sufficient to store only a moderate amount of the surplus water; but with the steady and rapid growth of the city, it has been necessary to build successive dams throughout the watershed, until finally the great Croton dam, which has just been completed, was put in service, thereby adding about 30 billion gallons to the total storage capacity.

A careful record of the river's flow has been kept for the past thirty-eight years. The records show that four times during one or other of the two months of December and January the natural flow of the river has fallen below 100,000,000 gallons per day, and that in December, 1876, it fell to 71,000,000 gallons per day.

Diagrams which have been prepared in the Aqueduct Commission's office give startling evidence of the way in which the city has been skating on thin ice with regard to its water supply. At times the surplus in the reservoirs has been drawn down to a point which, taken in conjunction with the limited flow of the river, has brought the city face to face with water-famine conditions. Thus, in November, 1891, a point was reached in which the supply of water behind the dams had been entirely drawn off, and the only reserve that the city had to fall back upon was that contained in the small distributing reservoirs within the city, in which was contained at the time only about one day's supply. Within twenty-four hours the city would have found itself depending entirely on the natural flow of the river which, at that time, was only 50,000,000 gallons per day; although the rate of consumption was 140,000,000 gallons per day. Nature dealt mercifully with New York city in this crisis, and withheld the castigation which its improvidence so richly deserved. There was a fall of rain, which tided the city over until other following rains served to fill the reservoirs.

Regarding the present conditions, we are informed that had not the gates of the Croton dam been filled last spring before the structure had been completed to full height, and over a month's supply thus preserved for city use, New York would now be perilously near to a grave shortage of water. As it is, the extremely small snowfall of this year, and the possibility of a continuance of the present open weather, render it unlikely that the reservoirs will be rapidly filled by melting snows, as they were in the spring of last year. If we do have a season of light rainfall, there will be a feeling of decided apprehension in the Aqueduct Department. The two additional reservoirs, with a combined capacity of 25 billion gallons, which are now being built in the Croton watershed, will not be available until 1908-9, and even they will merely serve to give a temporary relief. It is not necessary to point out the moral of the above facts, and the extreme urgency of pushing forward the completion of the Esopus water supply with all possible dispatch.

NEW CONCEPTIONS IN ASTRONOMY.

After three centuries of what may be called accurate, or instrumental astronomy, three centuries filled with difficulties and discouragements, astronomers have finally arrived at conclusions given in this note. The conception is, that all that part of the sidereal structure visible in the most powerful telescopes, is made of space, suns, planets, moons, nebulæ, comets, meteors, and cosmical dust. The word "star" should be omitted from astronomical literature. It has no astronomic meaning. Every star visible in the most penetrating telescope is a hot sun. They are at all degrees of heat, from dull red to the most terrific white heat to which matter can be subjected. Leaves in a forest, from swelling bud to the "sere and yellow," do not present more stages of evolution. A few suns that have been weighed, contain less matter than our own: some are of equal mass; others are from ten to twenty and thirty times more massive, while a few are so immensely more massive that all hopes of comparison fail.

Every sun is in motion at great speed, due to the attraction and counter attraction of all the others. They go in every direction. Imagine the space occupied by a swarm of bees to be magnified so that the distance between each bee and its neighbor should equal one hundred miles. The insects would fly in every possible direction of their own volition. Suns move in every conceivable direction, not as they will, but in abject servitude to gravitation. They must obey the omnipresent force, and do so with mathematical accuracy.

The first fact that strikes the beginner in astronomy is the amazing magnitude of space. The last that overwhelms the mind of a mature astronomer is this never-ending space. It is now known to modern mentalists, lately newly discovered—the ancient students of mind knew it—that our minds are unable to think of the following six words: Space, infinity, eternity, creation, beginning, and end. They are all unknowable, and the chief mathematicians of the world do not try to think of them—a sheer waste of time.

The distance from our "star," the sun, to its nearest known neighboring sun is twenty-five trillion miles. A trillion is a million million. An object moving on a straight line without stopping, at a constant rate of one mile per minute (we think that a train running at the mile-per-minute rate is moving rapidly) would require more than 48,500,000, nearly forty-nine million, years to traverse this appalling distance. Yet this is a mere yard-stick used to measure the distances of remoter suns. The next brain-stupefying mystery met with is the velocity of light. It is known to be in motion always with the tremendous speed of 186,000 miles per second. There are in one sidereal year 31,558,149 seconds, and the time required for light to traverse the mighty void between our own and its nearest sister sun is 4.3572 years. The distance from the earth to the sun is 93 million miles, and to the nearest neighboring sun is 275,000 times 93 million miles. The next nearest neighbor our sun has is another, 590,000 times 93 million miles away. The distance from the earth to the sun is merely a foot-rule. The star Sirius is roughly of the same distance. But these are "near-by" suns. Estimates based on luminosity, light-giving power, and other complex considerations, have been made regarding the diameter of the visible universe. These range all the way from 10,000, 15,000, 20,000, and even up to 30,000 "light years." A light year is the space traversed by light in one sidereal year and equals 31,558,149 multiplied by 186,000. To find the diameter of the universe, multiply the product by 10, 15, 20, or 30 thousand, as you please. The opinion of the writer inclines toward the thirty thousand. Now the words finite and infinite in this case are equally unknowable, for the ablest human mind is totally unable to think of either. Mathematicians have tried their hands, as a recreation, at weighing all the stars. That is, finding the quantity of matter they all contain. They discovered a mighty fact: the mass of all visible stars in the greatest telescope is so small in comparison with the quantity of matter that mathematicians can feel, not see, that it may be almost neglected. Therefore the main quantity of matter does not emit light. The universe is nearly dead. Photographs of the entire celestial vault reveal about one hundred million suns. These may be ignored. It is known to mathematicians that there is matter enough in existence to make thirty-two billion suns equally as massive as our own. Proof is had from velocities of rapid suns. This quantity of matter exists. A minute fraction appears in the form of visible suns. But what of the rest? Is it in dead suns, planets, and moons? Suppose that matter has been divided into 32 billion suns, each having eight minute planets revolving around as in the case of our own. Then the number of worlds would be 256 billion. As the combined mass of all the planets in our solar system is but the 1-745th that of the sun, it has made no perceptible difference whether planets, habitable worlds, ever existed, or exist now. Planets and moons may come or go, without making more than miscroscopic differences in the stupendous universe. Is it possible that billions of exhausted suns are now wandering in waste places of space? And are they all surrounded by dead planets, still in revolution, counting off lifeless and useless years? This is the result obtained by late mathematical research. Many suns are known to contain several thousand times more matter than is now in our sun, such as Antares and Canopus. Sirius contains three and one-half times as much, and Arcturus perhaps ten times the solar mass. Our sun contains 333,000 times more matter than the earth. The heat conditions of suns and also their motions toward and from the earth, have been discovered by that standing marvel of the nineteenth century, and more marvelous in the twentieth, that all-powerful work of human hands, the telespectroscope. Could Newton, Kepler, La Place, La Grange, rise from their sleep of death and see what this marvelous instrument has accomplished, they would be amazed and wonder if they were really on earth again. No attempt can be made to describe it here for lack of space. Only one more powerful entity exists—mathematics. Many thousands of cases of binary suns are catalogued. These are where two suns revolve around their common center of gravity, usually in greatly elongated orbits. Planets with organic life could not exist in revolution around either. The ani-

mals would be burned to a crisp when the two suns were near each other, or frozen solid when far apart. The nebulæ are enormous masses of gas seen in all parts of space. It is supposed that suns are condensed from them during vast periods of condensation. Many thousands are known. Meteors are primitive masses, each as "ancient as the sun." Suns and planets constantly receive them from space; in fact, it is thought that primeval gas first condensed into meteors, and that they then, flowing into many billions of centers, builded suns, planets, and moons. Comets are merely large meteors, or collections of millions of much smaller bodies, as bolides, uranoliths, chunks of meteoric iron, small granular particles no larger than grains of sand, and other debris, all assembled and in flight around suns. And such is the modern concept, in dim outline, of modern astronomy. One hundred million worlds like the earth could come to an end at once and make less difference in the cosmical structure than a pebble dropped into a river. The inscrutable mystery is, how beings so minute as men can possibly find out these simply wonderful facts.

PROF. EDGAR L. LARKIN.

THE VOYAGE OF THE "DISCOVERY."*

Among the recent contributions to the literature of Polar exploration and research, is the account of the English "Discovery" expedition to the Antarctic. In two large volumes Capt. Robert F. Scott, commanding this, the National Antarctic Expedition, tells of the work accomplished during the two years' sojourn within the Antarctic circle. The narrative is written with simplicity, directness, and a certain charm of style. While parts of the account go into scientific detail for the benefit of future polar voyagers, the book will be found interesting even by readers not directly concerned in Antarctic exploration.

The institution of the "Discovery" expedition was due almost entirely to the efforts of Sir Clements Markham and the Royal Geographical Society. After the usual difficulties in securing necessary funds and governmental co-operation, the sum of £47,000 was finally raised by private subscription, and this with the £45,000 contributed by the government, placed the enterprise on a sound financial basis. It was decided to build an entirely new vessel for the purpose, and in March, 1900, at Dundee, was laid the keel of the "Discovery." The ship was built in accordance with the most advanced ideas of naval architects and explorers. In June of the same year, R. F. Scott, then First Lieutenant of H.M.S. "Majestic," was appointed to command the expedition. The year following was busily occupied in completing arrangements, procuring all necessary apparatus and supplies, and selecting the other members of the party, which consisted almost exclusively of naval men.

The "Discovery" left London July 1, 1901, and arrived at Lyttleton, New Zealand, on November 29. The final leave-taking from civilization occurred on December 24, when the ship sailed from Port Chalmers, where a last supply of coal had been taken aboard. After working through the pack-ice, Victoria Land was first sighted on January 8, 1902. A southerly direction along the coast was continued, with landings at Cape Adare, Lady Newnes Bay, Granite Harbor, and other points, for survey and investigation, until further progress was made impossible by the ice pack in McMurdo Sound under the volcanic Mounts Erebus and Terror. The ship was now turned eastward in an attempt to solve the problem of the great Ross Ice Barrier. This was followed along its entire length to where it joins with King Edward VII. Land, the coast of part of which was explored. The Barrier was thoroughly investigated, at one point even by means of a balloon ascension. By February 8 the "Discovery" was again in McMurdo Sound, which was then found free of pack-ice. Winter quarters for the ship were chosen on the southwest coast of Ross Island.

The first winter in the Antarctic was occupied with meteorological, magnetic, and other observations and investigations, in becoming accustomed to the unusual conditions of livelihood necessitated by the region, and in making short expeditions into the surrounding territory. As soon as the approach of warmer weather permitted, sledge journeys for wider exploration were started. The first of these was Armitage's journey from Mount Erebus westward into the continent for about a hundred miles from the coast, ascending glaciers and mountains, to a smooth, open, snow-covered plain, over which he traveled till failing provisions forced a return. Another party, under Scott and Royds, made reconnoissances to the south. Another party under Royds left communications at Cape Crozier, for the guidance of a relief ship. On November 2, Capt. Scott started on his sledge journey along the Antarctic continent for 350 miles south of the winter quarters at Ross Island. Inexperience, loss of the entire dog-team, incipient scurvy, and late bettering of weather conditions, made this achievement noteworthy. The farthest south was 82 deg. 16 min. 33 sec., a point 250 miles nearer the pole than had theretofore been attained. Meanwhile the relief ship "Morning" had arrived. This southern journey of Scott's ended on February 3, 1903, after 960 statute miles had been traveled in 93 days.

As the ice did not break up, the "Discovery" was obliged to spend another winter at Ross Island. The second season passed in almost the same manner as the first, and with the beginning of warmer weather, preparations for further sledge journeys were energetically pushed forward. Several short but severe trips were undertaken, either for the purpose of local exploration or to arrange depots for the later journeys. The first of these, starting on October 6, was that under Barne, to the southward toward Barne Inlet. Capt. Scott himself left on October 11, for a western journey through the Ferrar Glacier, into the great waste of Victoria Land. After a journey replete with adventure and terrible traveling, the return was accomplished late on Christmas Eve. The sledge party traveled inland for 270 miles, and found that the vast continental plateau rises to a height of over 9,000 feet above the sea, a great, monotonous, undulating plain covered by the perpetual ice-cap. In an absence of 59 days, over 725 miles had been covered. Barne's party encountered great difficulty with bad going and severe weather, and was forced to return after having barely reached the mouth of the inlet which they hoped to explore. They discovered, however, important proof of the moving of the great Ice Barrier, when it was noted that one of the supply depots established thereon had moved considerably from its original location. This party returned to the vessel on December 13, after being out 68 days. The southeasterly expedition to the interior of the Great Barrier, under Royds, returned on December 10. The party marched day after day over the same monotonous and unutterably wearisome plain of ice and snow. Extremely valuable magnetic observations were made, as here these were absolutely free from possible disturbance, either from casual iron or from land-masses.

In January, 1904, 20 miles of solid ice separated the "Discovery" from open water, and an attempt to saw a channel was seen to be impossible. On January 5 the relief ships "Morning" and "Terra Nova" appeared. As the ice gave little hope of breaking up, preparations were made to abandon the ship, and to transfer the valuable contents to the relief vessels. By February 16, however, the "Discovery" was freed with the help of explosives, the miles of intervening ice having previously been broken up by stress of weather. From McMurdo Sound the little fleet ran north along the coast, the "Morning" soon leaving for New Zealand, while the other two continued to the north. Shortly after the "Terra Nova" and the "Discovery" separated and the latter turned to the westward between latitudes 67 and 68. The Balleny Islands were found to be identical with the three Russell Islands of Ross. It was also found that the extreme eastern part of the coast line indicated by Wilkes does not exist, and this disproves the hypothesis that the coast of Wilkes Land is extended eastward in a long connected line to Victoria Land. Thus it is probable that there is an important recession of the shore to the west of Victoria Land, which may be a broad peninsula. On March 15 Ross Harbor, Auckland Island, was reached, where the other two vessels soon joined the "Discovery." On April 1 Port Lyttleton was entered, and the final return to civilization accomplished. September 10 saw the "Discovery" again at Spithead, England, after an absence of three years and one month.

The two years of strenuous work were crowned with success. The eastern edge of the Antarctic continent was traced for 350 miles south of the winter quarters, thus completing a fair survey of about 1,000 miles, including coastal irregularities, of this shore line extending mainly north and south. The explorations of the surface of the Great Barrier and the inland continental plateau were extensive, notwithstanding initial and complete ignorance of sledging and sledging methods. The complete survey of the edge of the Ice Barrier to where it joins the newly discovered King Edward VII. Land, proved that the Barrier has receded considerably since the time of Ross. It is not considered a land ice-cap, but is believed to be an ice-mass afloat on a great sea basin. The extreme southern dash was made on the surface of this Ross Barrier, a huge plain so flat that even slight objects could be seen for miles. It is bordered, on one side at least, by high mountains, some of which reach elevations of 12,000 to 15,000 feet, and these continued as far as could be seen from the farthest point south. The opinion has been advanced that possibly these mountains extend over the pole as a continuation of the mountains of Graham Land and the Andean chain. The geographical, meteorological, zoological, and magnetic and other physical investigations are of great value, and go far to show that the voyage of the "Discovery," as Capt. Scott says, "was not undertaken in a spirit of pure adventure, and that the members of the expedition strove to add, and succeeded in adding, to the sum of human knowledge."

* The Voyage of the "Discovery." By Capt. Robert F. Scott, C. V. O., R. N. In two volumes. London, 1905, Smith, Elder & Co. New York: Charles Scribner's Sons.

SCIENCE NOTES.

Hardly any theory is all true, and many theories are not all false. A theory may be essentially at fault and yet point the way to truth, and so justify its temporary existence. We should not, therefore, totally reject one or other of two rival theories on the ground that they seem, with our present knowledge, mutually inconsistent, for it is likely that both may contain important elements of truth.

A new industry, the making of mattresses, pillows, etc., of sponge, has been started in Florida. The sponge material is cleansed of all foreign matter by a scrubbing process in large tanks of water, then run through wringers, and the drying continued by subjecting it to a cold-air blast. It is then shredded by machinery, sterilized, and rendered odorless by chemical treatment, and subjected again to cold-air drying, when it is ready for use. It is claimed that the sponge mattresses are only about one-third of the weight, and cost only about two-thirds as much as those of the same size made of hair, that they are thoroughly springy, yet firm and durable, and that they are especially sanitary, the material being non-absorbent of moisture and emanations from the body. A pillow is made measuring 19 by 26 inches which weighs only one pound, feather pillows of the same size weighing three pounds. Other articles are a sponge cushion and a toy sponge ball as light as an inflated rubber ball.

The berries of different species of coffee generally contain from 10 to 15 grammes of caffein per kilogramme. M. Bertrand, in a recent communication to the Académie des Sciences, shows that there are exceptions to the rule. The coffee of the Great Comaro, to which Baillon has given the name of *Coffea Humblotiana*, does not contain the slightest trace of the alkaloid. This exception is the more curious, as this species much resembles the ordinary kind, the *Coffea arabica*. The absence of caffein in the coffee of the Great Comaro is not due to the influence, either of the soil or of the climate of the African island. Analysis of the *Coffea arabica*, cultivated in the same island, has yielded a normal percentage of caffein, 13.4 grammes per kilogramme of the berries. Other coffees gathered near Diego-Suarez in Madagascar, and quite distinct species, exhibit the same peculiarity, the absence of caffein. This fact is not accidental, but a distinct characteristic of certain species, previously found only in Madagascar.

Prof. Moreaux describes in a paper, read at a session of the Académie des Sciences, observations on a waterspout which passed through the communes of Saint-Maur and Champigny on the 28th of August. The direction was from west-southwest to east-northeast. It seems to have been formed to the south of Saint-Maur-ice, and passed over a space of about five kilometers in twenty-five minutes, from 10 minutes after 3 o'clock to 35 minutes after 3 o'clock in the afternoon. It was noticed at the observatory of Saint-Maur when it had completed about half of its course. Its passage was accompanied with a sound which is described as resembling that of a battery of artillery drawn on the gallop over a paved street. At the base of an extended nimbus hung the reversed cone characteristic of phenomena of this kind. The barometer, 11 millimeters lower than the day before, stood at 745 millimeters at an altitude of 50.3 meters, at 5 minutes after 3 o'clock, when the fall was increased. A strong wind was then blowing from the south-southwest. The temperature was 15 deg. C. These two conditions did not change. The waterspout passed to the north of the observatory within a distance of about one kilometer. It was preceded by a storm, and followed by a shower.

The ordinary methods for the determination of refraction, of which the influence is so considerable in all astronomical measurements, are attended with great difficulties. Observations must be accumulated during a course of years, and at the same time estimates must be made of the multiple effects of the numerous causes that may intervene in measurements taken by means of meridian and other similar instruments. M. Loewy, who has studied this subject closely, pointed out several years ago two methods by which the inconveniences might in great part be avoided. They were based on the comparison of the stellar distances by the use of a special compass, of which the opening remains constant; this consists of two mirrors cut from the same block of glass in prismatic form. With the aid of this optical apparatus before the objective of an equatorial, the distance between two stars may be determined, whatever the size, with much precision. The constant of refraction may be deduced under certain conditions. In a new communication to the Académie des Sciences, he has recently made known an improved method free from the practical imperfections of the previous theoretical solutions. By means of a single prism the refractions can be exactly measured at all zenithal distances, by taking advantage of the fact that the apparent distance between two stars is not diminished by the effect of refraction, provided the vertical circle of one of the stars is perpendicular to the arc of the great circle which joins them.

NOVEL METHODS OF DETERMINING THE AMOUNT OF ATMOSPHERIC DUST.

BY DR. ALFRED GRADENWITZ.

Many methods have been suggested to ascertain the amount of dust contained in air of large cities. The

Glass block with ground spherical segment containing a resin plate. Pincers with covering glass. Ladle for preparing resin (or varnish) and glass rod for transferring the resin to the glass plate.

Preparing the Dust-Collecting Plates.

best known of these consists in drawing a certain amount of air through a cotton or glass wool filter, and in weighing the filter before and after the operation. This, as well as many other processes identical in principle, are not of much value because of the great differences in the specific gravity of dust particles. Air containing little dust but including many mineral components or even dust from heavy metals might for instance result in an increased weight of the filter, whereas but a slight increase would result from the absorption of light organic matter. Moreover, it requires many hours to draw in an amount of dust susceptible of weighing.

In other processes the number of the dust particles is calculated, for which purpose an apparatus is employed by means of which the air is drawn against a plate lined with a moist substance, after which the adherent dust particles are counted by the aid of a microscope. Their number for each liter of air is ascertained from the averages found for a number of sections, multiplying the number of sections by the average and dividing by the number of liters of air which traverses the apparatus.

An interesting method invented by John Aitkens is based on the observation that water is separated as cloud from air saturated with steam only when dust particles are present.

An especially simple and practical method has been recently invented by Dr. Vörner, of Leipsic, and Prof. F. Hofmann. This method is also based on the counting of dust particles. Weight is not considered.

In constructing his apparatus, Dr. Vörner availed himself of the fact that the dust deposited on polished black surfaces is easily seen. As neither polished ebony surfaces nor dark glass plates were available for his purposes, owing to the fissures revealed under the microscope, Dr. Vörner decided on preparing special plates to be used for the deposition of dust. After melting a blackened resinous substance, a certain amount of it was applied to a glass plate and allowed horizontally to solidify. On observation under the microscope, the fresh surface was seen to show an absolute uniformity and perfect polish. Though ordinary daylight was quite sufficient for an observation of these dark plates, there was the disadvantage of the inconstancy of illumination, the details being seen more distinctly in the case of illumination by sunlight than with dim daylight. Dr. Vörner therefore used an incandescent gas lamp placed at a certain distance from the microscope, the light being concentrated by a large convex lens, so as to have the focus fall on the surface of the dark plate. The distance of the lens from the microscope being kept constant, the surface illumination thus obtained showed a strictly constant intensity, the light striking the plate at an angle of about 37 deg.

If a fresh resinous surface be observed under the microscope, some strongly refracting points will be found to spring up gradually in ever-increasing numbers, these points being nothing else than dust particles coming down from the air. The whole plate thus assumes the appearance of a star-lit sky, the suddenly appearing particles reminding one of shooting stars. It may be remembered that the above outfit is quite similar to the *ultra-microscope* constructed by Siedentopf and Zsigmondi. Experiments showed the dust particles to be fixed in position by the resinous mass.

Now, in order to keep the resin plates free from dust up to the moment the experiment is started, Dr. Vörner placed a glass ring ¾ millimeter in height on the semi-liquid resinous mass, and on which was placed a watch glass freed from any dust by heat, the space between the glass ring and watch glass being filled with vaseline.

Before beginning an experiment, the watch glass is removed with a pincette and exposed for ten minutes, after which it is replaced in position, the resin plate observed under the microscope and the number of dust particles per square centimeter calculated.

According to a modified process, Dr. Vörner has tried to ascertain the amount of dust contained in each liter of air by the aid of airtight boxes lined with vaseline and kept closed for at least twenty-four hours, during which time the dust from the inclosed air is entirely fixed on the walls and at the bottom. When placing a newly-opened resin plate at the bottom of the box before the experiment is begun, the dust can be readily gaged under the microscope.

Dr. Vörner has used his process in extensive experiments, intended mainly to ascertain the percentage of dust in the air of dwelling rooms, on streets, public squares, in parks as well as in schools, auditories, gymnasiums, and the like.

Experiments on the composition of the air of Berlin streets have been recently carried out at several places where dust collectors more than 2 meters in height were installed. As no official data have so far been made public, we are unable to state what method has been used. Anyhow, these dust collectors were round sheet metal boxes more than 50 centimeters in height, the cover of which remained open and was allowed to receive the dust kept in suspension in the air. Some time afterward the sheet metal box was closed and taken to the chemists, who analyzed the dust contained in the collectors. It was intended by these observations mainly to ascertain what bacilli and what amounts of substances prejudicial to the organs of respiration are contained in the dust.

As, however, these experiments were soon abandoned, without any report being published, it would rather seem as though the apparatus was not efficient enough to warrant the anticipated results.

The writer is indebted for part of the above particulars to Dr. K. Stich, of Leipsic, who has carried out extensive experiments with the Vörner dust-gaging outfit, mostly in connection with a spraying apparatus constructed by himself for the laying of dust in large halls.

The Dust Collector Set up in a Prominent Square in Berlin.

NOVEL METHODS OF DETERMINING THE AMOUNT OF ATMOSPHERIC DUST.

It is estimated that the annual consumption of coal in New York is fifteen and one-half million tons.

Lightning Stroke and Magnetism.

The recent researches made in Italy by G. Platania show the magnetizing effect of lightning discharges upon volcanic rock. M. Folgheraiter found that in the volcanic regions a certain number of highly magnetic points or areas could be located, and here the effects of lightning were also observed, so that the magnetizing effect seemed to be due to this cause. However, the same points had never been investigated both before and after the lightning stroke. The writer commenced researches upon the magnetism of rocks from the Etna, and tried whether the wall of a house which was built of blocks of basaltic lava and brick showed any magnetic effect, but this was too small to be appreciable. On the 20th of September last a severe storm caused the fusion of a telephone wire, leaving the earth wire which ran down along this wall intact, and the lightning discharge must have passed down this wire. The next morning he found that the corresponding part of the wall showed a strong magnetic effect for a distance of 6 inches, having the north pole to the left. The discharge current must have thus been directed from the bottom to the top. During the same storm, lightning struck Sig. Frorini's residence, causing some damage. The lightning rods of copper are held on insulators about 6 inches from the wall. The house is a new one, and had never before received a lightning stroke. While the lava blocks forming the wall which lie far off show scarcely any magnetic effect, when we come near the lightning rod the action of the wall upon the needle is seen at 10 feet distance. It seems remarkable that such strong effects are produced by an insulated wire lying so far from the wall.

Microscope with glass block. Condensing lens. Illuminating lamp. Box for transporting glass blocks.

The Experimental Outfit for Testing Street Dust.

The Current Supplement.

The current Supplement, No. 1570, opens with a continuation of our Paris Correspondent's observations on the Paris Automobile Show. One of the largest examples of the application of suction gas engines to the propulsion of boats for river navigation is furnished by the German vessel "Lotte." This craft, which is driven by producer-gas engines, is fully described and illustrated. Lieut. H. J. Jones's splendid monograph on armored concrete is continued. Dugald Clerk, one of the world's greatest gas engineers, discusses in a most lucid and authoritative manner the problem of the gas turbine. The human organism has often and aptly been compared with a fine piece of machinery. An excellent article graphically illustrates how true this simile is. Rear-Admiral George Melville, former Chief Engineer of the United States Navy, discusses liquid fuel for naval and marine purposes. The imitation of geological phenomena by means of various experimental arrangements is undoubtedly a great help to the teacher. How simple apparatus can be constructed which will excellently demonstrate the effects which have been produced by various geological causes is told in a well-illustrated and thorough article. Of interest to the naturalist are brief but instructive descriptions of the bee louse, and the habits and life history of a social spider.

The Award of the Fritz Medal.

The second award of the John Fritz medal has been made to George Westinghouse. This medal was established by the professional associates and friends of John Fritz, of Bethlehem, Penn., on August 21, 1902, his eightieth birthday, to perpetuate the memory of his achievements in industrial progress.

THE BATES PLAN FOR LOCK AND LAKE CANAL AT PANAMA.—II.

In the construction of a canal at Panama, there are three primary considerations which surpass all others in importance. They are:

1. To control the Chagres River and find some safe means of passing its enormous floods down to the sea without interfering with the canal.

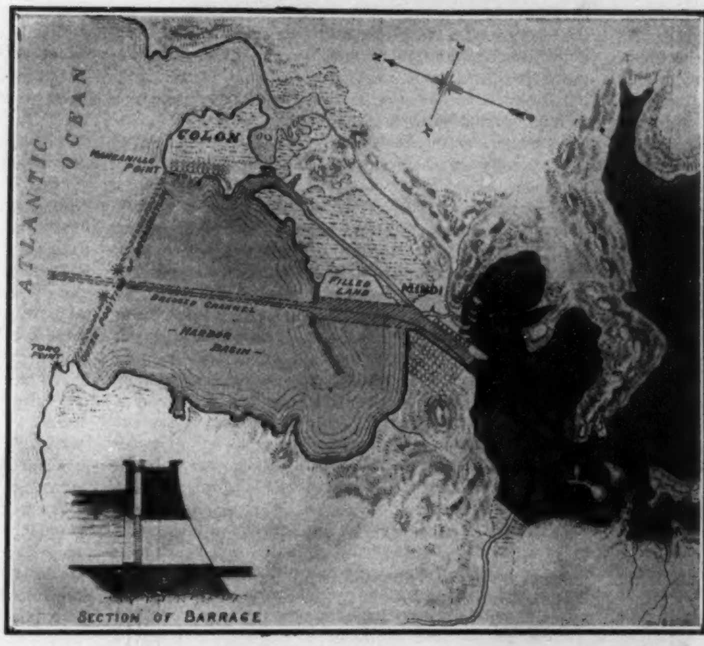
2. To strike such a fine balance between the many competing advantages of the various types of canal possible, that the particular plan adopted shall represent the best average of certain desirable qualities in a canal of this character. That is to say, it must be built within a reasonable time, for a reasonable sum, and with such due regard to engineering requirements that there must not be the shadow of a doubt as to its permanent stability. Moreover, the transit of the canal, as completed, must be made in the least possible time consistent with its possession of the above desirable qualities.

3. The third consideration, which in some respects is the most important of all, is that of finding the best method of disposal of the enormous amount of material excavated from the prism of the canal.

The plans herewith presented of Mr. Lindon W. Bates, a hydraulic engineer and contractor of world-wide reputation, are of particular interest, for the reason that he has taken up the study of the Panama Canal problem from the standpoint of an individual and unbiased technical observer. After a most exhaustive study of the subject, in which he went carefully into the history of the deliberations of the many technical bodies that have studied the Panama Canal problem, Mr. Bates made a personal visit to the Isthmus, and on his return wrote an elaborate work reviewing the history and present status of the problem, and outlining the scheme which he considers to be the best adapted to the situation. It is the purpose of the present article to give such a digest of this work, that the essential features of Mr. Bates's plan may be made clear to the non-professional public.

I. CONTROL OF THE CHAGRES: A glance at the accompanying map of the Panama Canal shows that it is located across an isthmus, about 40 miles in width, which is traversed by certain ranges of hills, that run approximately parallel with the coast, dividing the isthmus into a series of rather narrow valleys. The principal range of hills is the main Culebra divide, which extends parallel with the Pacific coast at a distance of about 10 miles therefrom. The slope from this divide toward the Pacific is drained principally by the Rio Grande, which enters the Pacific near Panama at the western terminus of the canal. The drainage of that part of the isthmus lying between the Culebra divide and the Atlantic is carried to the sea by the River Chagres, which at first flows parallel with the divide in a southwesterly direction, until it strikes the axis of the canal at Gamboa, where the river swings abruptly to the right and receives, on its way to the Atlantic, the drainage of several other streams, two of which are of considerable importance, namely, the Gatuncillo, which flows down from the northeast through a valley that lies approximately parallel with the upper valley of the Chagres, and the Trinidad, which flows into the Chagres from the southwest. Under normal conditions these rivers present no great activity, the Chagres being in the lower levels somewhat sluggish; but under the influence of the tremendous downpour of tropical storms, the rivers become gorged with the waters of a mighty flood, the Chagres itself having been known to rise between 30 and 40 feet in 48 hours' time.

Now, for the safe and convenient navigation of a ship canal, it is absolutely necessary that there shall be no currents of a greater velocity than $2\frac{1}{2}$ miles an hour; and hence it is obviously impossible to permit the Chagres floods to pour into the canal itself. Mr. Bates's proposal contemplates the formation of a series of massive sluice dams, of the same character as those used so successfully in controlling the floods of the Nile at Assouan. One of these would be built across the upper Chagres valley at Alhajuela, about 9 miles

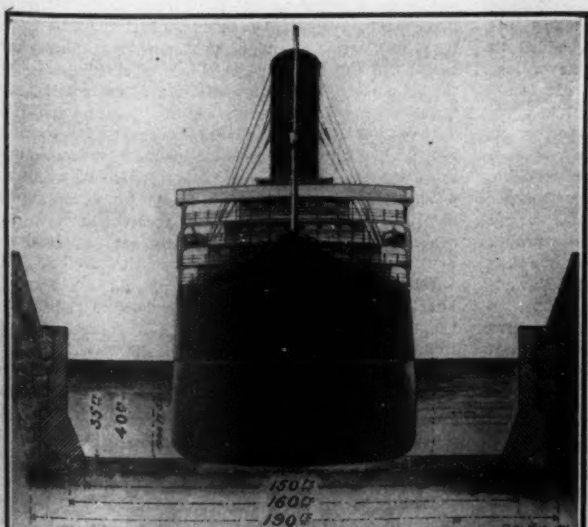


It is proposed to abandon swampy Colon and build a new town on the hill opposite Mindi.

Map Showing Fresh-Water Lake and New Harbor at Atlantic Terminal of the Canal.

Time necessary to construct, eight years. Total cost, $125,000,000.

Plan and Profile of the Proposed Lake-and-Lock Canal.



The dotted outlines show the great increase in size of steamships.

Section of Proposed Forty-foot Canal, Showing One of the New Cunarders Passing Through.

The new town site would be formed by filling in part of the harbor with the material excavated from the Culebra cut.

Map of the Proposed Terminal Lake, Harbor, and New Town Site of Panama.

THE BATES PLAN FOR LOCK AND LAKE CANAL AT PANAMA.—II.

above Gamboa; another would be built at Gamboa, where the Chagres first meets the line of the canal; the third would be built near the mouth of the Chagres on the Atlantic; and the fourth at the mouth of the Rio Grande on the Pacific. The impounding dam at Gatun would be solid and discharged by a spillway or barrage.

Now, the gates in the sluice dams at Alhajuela and Gamboa would normally be left open, and the basins back of them empty. But in times of flood the gates would be partly closed and the dams allowed to fill with the excess, their joint capacity, and in fact the capacity of the Gamboa dam alone, being far more than enough to take care of any single flood. When the flood had passed, the sluice gates at Gamboa would allow the impounded flood waters to discharge slowly into the canal, half of the water flowing toward the Pacific and the other half toward the Atlantic, the amount being regulated so that it would not produce a current of over 1½ miles per hour in the canal. The sluice gates in the barrages at the Atlantic and Pacific terminals of the canal, would be so regulated as to maintain at all times a predetermined depth of water in the central and terminal lakes.

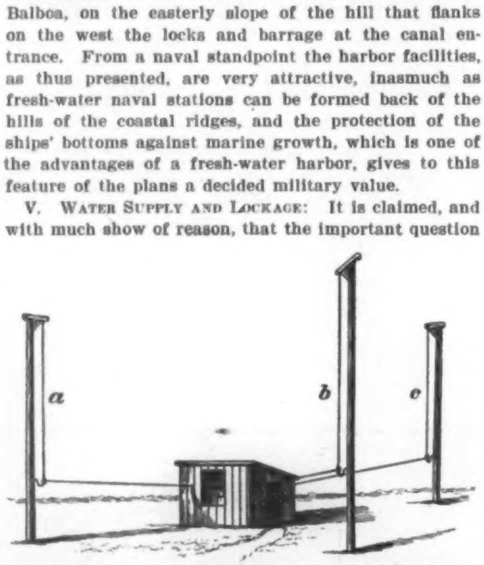
II. The Lake and Lock Project: The feature of Mr. Bates's plan which distinguishes it sharply from the plans that have preceded it, is the free use which he makes of the system of canalization by means of impounded artificial lakes. The method is not a new one as applied to the Panama problem, for it was suggested during the earlier studies of the question by the French engineer, Godin de Lapinay; and, later, it figured in the emergency plans for the quick completion of the canal, which were drawn up by the French when it became apparent that they were unable to put through a canal at sea level. No one, however, has attempted the canalization of the Chagres and Rio Grande rivers on the bold scale that is proposed by Mr. Bates. Of the three alternative plans which he offers, we have selected the one known as Plan B, which contemplates the use of four locks with two levels, and the formation of three large fresh-water lakes. The central lake (Lake Chagres) is formed by the construction of a dam at Gatun which serves to hold the water at a level of 62.5 feet above the mean sea level. In the Chagres lake the channel would be excavated along the bottom to a depth of 40 feet and a bottom width of 150 feet. The waters would back up the Chagres valley for a distance, measured along the ship channel, of about 20.6 miles. From this point the canal would be excavated, at the same surface level of plus 62.5, through the foothills and the main range of the Culebra divide for a distance of 10.5 miles to Pedro Miguel, where there would be a lock. This stretch from Gatun to Pedro Miguel, about 31.1 miles in length, would constitute the summit level, 20.6 miles of it consisting of lake navigation, and 10.5 miles only consisting of canal proper, bounded by nearly parallel banks. The remainder of the canal, both on the Pacific and Atlantic sides, would be formed by creating two large terminal lakes with their surface held at an elevation from 26.5 to 33.5 feet above mean sea level, and dredging out the ship channel to a depth of 40 feet and a bottom width of 150 feet.

These two great terminal lakes are, perhaps, the most attractive feature in Mr. Bates's plan; for they not only serve to greatly reduce the amount of necessary excavation, but by flooding the swampy land lying adjacent to the canal termini they assist in the improvement of sanitary conditions. By referring to the accompanying maps showing the terminal harbors, it will be seen that the topography of the country lends itself admirably to the construction of these dams, for in each case the rivers, as they approach the ocean, pass through a natural depression of inconsiderable width formed in the ridges that extend approximately parallel with the coast line.

III. Terminal Harbors: The provision of terminal harbors and safe entrances is an important feature in any great ship canal such as this, and in the plans under consideration it has received particular attention. As stipulated by the act authorizing the construction of the canal, these harbors should provide secure military and naval bases. By reference to our map of the Pacific terminus, it will be seen that breakwaters are designed whose arms are to inclose the whole harbor of Panama and La Boca, and extend from the mainland to the islands that face the entrance. As these breakwaters would be built of the rock excavated from the canal, they would represent but little additional cost over that which would be involved if the excavated material were wasted at sea. The location of the canal is changed from the curved line of the old location to a straight line which extends from the upper end of the terminal Panama Lake, straight out through the harbor entrance, as shown on our map. It passes through locks which will be built adjacent to the barrage on good rock foundation in the Ancon-Sosa Saddle; while to the southwest, beyond a stretch of rising ground, is the dike, less than a mile in length, which serves to impound the waters of Lake Panama. At the Atlantic end a similar provision of breakwaters serves to form a sheltered harbor at the entrance to the canal, and advantage is taken of depressions in the topography of the hills near the coast by placing the canal entrance, the barrage, and the locks in one depression, and the impounding dike in the narrow valley of the lower Chagres. In this harbor also the alignment of the canal will be straightened and its length proportionately reduced. The creation of these two harbors, coupled with the large fresh-water lakes adjoining them, will provide such extended facilities for the safe harboring of ships, both of the navy and the mercantile marine, that it is not possible for any increase in future canal navigation to cause congestion at these points.

IV. Disposal of Excavated Material: One of the greatest problems, if not the most important, is the disposal of the enormous amount of excavated material, chiefly from the Culebra cut. In the plans under consideration, Mr. Bates brings the bulk of the Culebra excavation down to the Pacific coast, and dumps it inside the big harbor formed by the breakwaters above referred to, until a large area of the harbor, several square miles in extent, has been filled in and brought well above high-tide level. Upon the site thus formed he would build a greater Panama, providing a splendid and healthy site for the great growth which must take place in this important terminal city. At the Atlantic terminus he advocates the abandonment of the old town of Colon, and the creation of a new town, to be called Balboa, on the easterly slope of the hill that flanks on the west the locks and barrage at the canal entrance. From a naval standpoint the harbor facilities, as thus presented, are very attractive, inasmuch as fresh-water naval stations can be formed back of the hills of the coastal ridges, and the protection of the ships' bottoms against marine growth, which is one of the advantages of a fresh-water harbor, gives to this feature of the plans a decided military value.

V. Water Supply and Lockage: It is claimed, and with much show of reason, that the important question



ARRANGEMENT OF THE AERIALS FOR DIRECTING THE MESSAGES.

of water supply for lockage purposes, in view of the great increase in vessel dimensions, has never received the careful attention which its importance demands. Mr. Bates considers that with the great growth in tonnage passing through the canal, which is certain to occur as the years go by, the mere creation of a single storage basin in the upper Chagres valley would not provide, especially in the dry season, a safe reserve for lockage. This is shown by the following figures: The three dry months of the dryest year in which gagings have been taken at Bohio show an average discharge of 742 cubic feet per second. By moving the impounding dam from Bohio to Gatun, the waters of the Trinidad and Gatuncillo become contributory to the water supply, and the average flow in a dry season for the same months of these rivers, added to that at Bohio, shows that there would be never less than 1,000 cubic feet per second available. It is assumed that the early traffic, when the canal is open, will amount to 7,279,000 tons, the lockage for which would require a flow of 306 cubic feet per second. Evaporation from the lakes will account for 280 cubic feet per second, leakage will equal 257 cubic feet per second, making a total of 843 cubic feet per second that is necessary to maintain the canal at its proper levels. This will give a surplus for the three dry months of at least 157 cubic feet per second. Now, if we eliminate waters coming in from the lower Chagres tributaries, it can be seen that instead of a surplus there would be a shortage of lockage water. Hence the importance of the inclusion of the drainage of the two tributaries of the Chagres above referred to in the total available supply of lockage water. When we consider the possibilities of storage in the navigated lakes and canal, it is evident that the transit capacity is far more than is likely to be required for many generations to come.

VI. Time of Transit: The most surprising claim made on behalf of the lake and lock project is, that the time of transit through the canal would be considerably less than if it were built at sea level. This is based on the fact that large ships in passing through a canal inclosed by banks, must proceed at a much slower speed than when they are steaming through a channel dredged in a navigable lake. It is claimed that the average speed through a sea-level canal could not exceed, safely, 4.23 miles per hour, including the time lost at the tidal lock on the Pacific, whereas in the lake and lock canal a speed of 7.08 miles per hour would be practicable. The higher speed in the waterway would more than offset the time lost in passing through the extra locks, so that the total transit time for the sea-level canal would be 12.39 hours, whereas for the lake and lock canal the time would be only 8.89 hours. The slow speed necessary in a canal inclosed by banks is due to the fact that, if a certain speed is exceeded, a ship, should it swerve from its course, has a tendency to swing, with accelerated turning movement, into either bank before the rudder can control it. This is due to the fact that the water cannot escape freely around the hull in a constricted channel as it can in a lake channel, where only the lower few feet of a ship's hull is in the channel and the body of the ship is in a wide expanse of water.

VII. Time and Cost of Construction: The erection of the impounding dikes and the barrages and the locks would be simplified by the fact that a good indurated clay rock exists at the selected sites, and that no difficulty would be experienced with the foundations. The creation of the inland lakes greatly reduces the total amount of excavation, which is brought down to a total of 118,430,000 cubic yards, as compared with an estimated total of 300,000,000 cubic yards for a sea-level canal. The estimated total cost is $125,000,000; and allowing from a year to a year and a half for designing the special plant that would be required and placing it upon the ground, it is estimated that the canal would be opened for navigation by the year 1915.

That the author of the above-described plan has the courage of his convictions is shown by the fact that he is prepared to put in a bid for constructing the whole canal at the rate of $3,125,000 per mile, reckoning the canal as 40 miles in length, to be completed under a guarantee in eight years.

BRAUN'S NEW METHOD OF DIRECTING WIRELESS MESSAGES.

By A. Frederick Collins.

The first attempts toward directing wireless telegraph messages were made by William Marconi some little time before he had evolved his aerial wire system. His apparatus consisted of a small induction coil fitted with a battery to supply the initial energy, a key to break up the current into the alphabetic code, and a Righi oscillator for radiating the energy in the form of electric waves. In this case the oscillator was mounted in the focal line of a cylindrical parabolic reflector the length and opening of which was double the length of the wave emitted from the oscillator. This arrangement permitted the waves to be concentrated into a beam which could be projected in any desired direction. The receiver consisted of a resonator formed of two plates of metal with a detector connected to and interposed between them; this was likewise placed in the focus of a similar parabolic reflector the opening of which was oppositely disposed to that of the transmitting reflector. With this combination it was possible to concentrate the waves into a beam, but the scheme was not practicable, at least over any considerable distance, since the oscillator and resonator systems were so limited in size that the emitted wave lacked the requisite amount of energy to be of commercial service.

In the Scientific American of October 7, 1905, the writer described a system for directing electric waves invented by Alessandro Artour, of Italy, who by an ingenious arrangement of the spark-gap spheres and aerial wires was enabled to obtain circularly and elliptically polarized electric radiations, thus forming rays capable of being propagated in any direction and without the use of grids to reflect them. Considerable success has attended these experiments, messages having been transmitted over 300 kilometers, while another station less than 100 kilometers distant and outside the effective line could not receive them.

Prof. Ferdinand Braun, of the Strasburg Institute, has recently brought out a new method for directing wireless messages in which it is not necessary to bunch the waves into a ray. His method is based on the theory of wave intensification and rarefaction by interference. Thus, assuming that two aerial radiating wires are tuned to the same period of oscillation and are energized by currents from the same oscillator, it should not be difficult to obtain interference phenomena provided the oscillations set up in one of the aerials have a phase difference of a small fraction of a second from those of the other.

While the time difference required between the two series of oscillations is exceedingly small, yet it is not easy to tune both oscillations to the same period and yet differentiate the time sufficiently to produce a lag necessary to bring about the desired interference.

This was finally accomplished in the laboratory by throwing the two series of oscillations out of phase by means of an inductance inserted in one of them

near the spark gap. The results on this small scale seemed to agree fairly well with the theory on which it was based and it was decided by the investigator to try out the system under conditions that prevail in practice, i.e., using loftier air wires and grounding the complementary terminal of the spark gap.

The place selected for making the out-of-door tests was the polygon military drill grounds at Strasburg. Three different stations were set up within this limited space, one for sending and the other two for receiving. At the transmitting station, instead of the usual aerial wire there were three radiating wires arranged at equidistant points from each other around the building and several meters from it. The aerials were suspended from the tops of their respective masts in the usual manner. The lower ends of these wires led into the building which housed the transmitting apparatus. The lower terminals of all the aerials were connected to one side of the spark gap, the opposite side of the latter being connected to the earth in the ordinary way. Now, when the disruptive discharge took place, the aerials *a b c* were energized by the oscillations thus set up, but while the oscillations in the aerials *b c* were exactly in step, those in *a* lagged slightly, due to the added inductance near the spark gap; yet the values of inductance and capacity remained identical, so that the length of the waves emanating from each remained constant. When all the aerials were emitting waves, those radiated by *a* would, in virtue of the fact that it was out of phase with *b* and *c*, set up an interference, with the result that an electrical shadow was cast in a direction at right angles to the plane of the aerial wires *b* and *c*, and hence the radiation of waves in that direction was a minimum. Oppositely, if the oscillations in the aerial *a* were made to take place in advance of those occurring in *b* and *c*, provided the difference in time was rightly proportioned, then a wave more or less amplified would result and its propagation would be in the direction previously stated, while the shadow due to the interference of the waves on *b* and *c* was projected from the rear of *a*.

In this system of amplifying the waves in one direction and diminishing them in another, the greatest difficulty seems to grow out of the fact that it is of the utmost importance to time the period of oscillation with absolute precision; and when it is stated that this difference of phase amounts to approximately only one ten-millionth of a second, it will be seen that the adjustments of the co-efficients are of an extremely delicate nature. From Prof. Braun's experience with high-frequency oscillations he concludes that the difference in time between the phases of the aerials can be adjusted to within one two-hundred-millionth part of a second, or more popularly expressed it would amount to a difference of only one second in six years.

Two or three years ago the scheme was tried to form a parabolic reflector of gigantic proportions by arranging a number of aerial wires around a radiating aerial wire so that the latter would be in the focal line. This arrangement failed to produce the desired results, since the wires thus placed permitted much of the energy to be lost through dispersion. Prof. Braun investigated the reflection of wires on a scale sufficiently large to show its utter impracticability. He employed waves having a length of 120 meters and placed the radiating aerial wire a distance of 30 meters or a quarter of a wave-length from the reflecting wires, which had an opening equivalent to the length of the waves to be emitted.

By utilizing the three-wire system the large and complicated reflecting-wire scheme is eliminated, the distance of transmission is increased and, what is equally advantageous, it is possible to direct the messages in any one of six directions. Without removing a single connection the waves can be sent in either one of two directions by merely increasing or decreasing the frequency of the oscillations in *a* so that these will be a ten-millionth of a second faster or slower than the currents that surge through *b* and *c*. By changing the relative phase values of *a b c*, it is obvious that any of six different predetermined directions can be obtained at pleasure.

In the recent experiments made by Prof. Braun and his co-workers, while messages were being transmitted in one direction and received by a station in line with it, a second receiving station at right angles to the line of propagation, though much nearer the transmitter than the first, was not affected.

Should it prove of advantage to transmit in more than six directions, five wires would be used, with the result that any one of ten stations, assuming they were located at equidistant points about the transmitting station, could then be communicated with to the exclusion of all the others. The maximum distance covered in these preliminary trials was 1.3 kilometers; it is stated, however, that a commercial test is to be made at an early date.

On her return trip the Cunard turbine steamer "Carmania" steamed on an average 17½ knots. During the whole voyage she met with persistent head winds. Her best day's steaming was 420 knots.

THE SOLDIER-MOUNTAINEERS OF ITALY.

BY WILLIAM G. FITZ-GERALD.

It is difficult for us who have practically no frontiers at all to realize the conditions that obtain in the Old World, where comparatively small nations adjoin one another like the squares on a chessboard; the boundary line in many cases being purely imaginary, and beyond it commencing a new language and a new country, with totally different manners and customs. In many places, however—as, for example, at the Franco-Spanish frontier, and also between Italy and Switzerland, and Switzerland and Austria—the boundary between the nations consists of a stupendous wall of snow-clad mountains; and as invasion is to be feared even across the lofty passes (did not the mighty Napoleon himself cross the great Alps with an army, carrying dismay and terror into Austria?) there are in European armies whole regiments that are carefully trained to fight literally "above the clouds." In other words, they combine the strength, endurance, and skill of the most intrepid Swiss Alpine guide with the ordinary profession of soldier. And there is nothing more interesting than to watch the maneuvers of these soldier-mountaineers—say, at Andermatt in Switzerland, or Aosta on the Italian side of the Great St. Bernard.

Andermatt is a village lying over 4,000 feet above the lower end of Lake Lucerne, and here will be found the headquarters of the Swiss Alpine troops, whose maneuvers should be seen to be believed, so daring are they, and so astonishing the spectacles presented by long files of panting men, small as flies on the wall of some terrible precipice, yet dragging literally inch by inch some big field gun up a tremendous slope by means of pulleys and hemp cables. One notices that these infantrymen are provided with alpenstocks and coils of silk rope, as well as snowshoes, ski, and other paraphernalia which we usually associate with the pleasure tourist in the high Alps—say at Chamounix, Zermatt, Grindenwald, or some other popular climbing center of the "Playground of Europe."

Their signaling is done from rock to rock by means of huge painted linen disks, held upon the outstretched arms of the signaler. The wounded are carried strapped "pick-a-back" fashion on a curious kind of easel-backed chair, fastened on the stalwart backs of their comrades. It is a fact that these troops maneuver literally "above the clouds"; and there is no more impressive spectacle than a Sunday morning service in some little icy recess at nine or ten thousand feet, when the chaplain of the regiment mounts into a rude portable pulpit, and discourses upon the wonders of the Almighty to the assembled soldiers who are shivering in their furs, even though it be July or August. At one side of the pulpit are the members of the band, and these play the hymns which reverberate through the awful desolations of glacier and snow-peak, gloomy gorge, and sky-piercing pyramid.

The Italian Alpine troops are in some ways still more remarkable. Indeed, I doubt whether as a whole any army in the world goes through such curious maneuvers as that of Italy. I have seen a prince of the House of Savoy—H. R. H. the Count of Turin—plunging into the River Arno at Florence at the head of his hussars, and the entire regiment swam across, each trooper with his arm about his trained charger's neck. I have also seen the same high commanding officer ride his regiment straight into the sea at Viareggio; for it is necessary to accustom both cavalrymen and the mounts to the negotiation of deep water, against the time they may find themselves in an enemy's country with all the bridges destroyed.

As one leaves the Swiss town of Martigny, and begins the long, toilsome ascent of the Great St. Bernard Mountain, one looks forward to reaching the Italian frontier at Aosta, by way of the far-famed hospice of St. Bernard, whose dogs and monks are a household word the world over. At the side of the lake near the hospice, a few stones mark the Italian frontier. As we descend, the scenery assumes a soft Italian character, and the awful desolation of Mount St. Bernard gives place to walnut groves, chestnuts, vines, and fig trees. Soon the southern spurs of Monte Rosa appear; and just before we enter Aosta, the pass is alive with soldiers. Some of them are marching on ski over the frozen snow; others again are glissading down steep slopes.

The little town lies about 2,000 feet above sea level, and is surrounded by ancient walls flanked with towers. On every side rise great mountains, like the 10,000-foot Becca di Nona, and the Mont Emilius, 11,670 feet. Aosta is an admirable climbing center, not only because the Italian Alpine troops have their headquarters here, but also because various Alpine clubs have built refuges and cut paths up colossal mountains, which would otherwise be inaccessible to any living creature save the Alpine bear and the chamois.

Aosta is filled with military barracks, and in these as well as in the open squares one sees embryo soldier-mountaineers in the making. Here is a party of recruits, half extended on the ground leaning on their left arms, while their right are high in the air, raising and lowering big weights. This exercise is to develop the muscles of arm and back for the long, tedious climb over high, snowy mountains, and across slippery glaciers abounding in treacherous crevasses, which may be covered by an insidious layer of snow, liable to give way at any moment after a burst of sunshine.

One great idea is to accustom these men to hauling and pulling; for while Alpine troops are on the march it is obvious they cannot take any pack animals with them, much less commissariat wagons. Each man is heavily burdened with rifle, bayonet, two or three hundred rounds of ball cartridge; several days' rations, a steel-pointed alpenstock, some silken or hemp ropes, snowshoes or ski, blankets, and other items, which in themselves make up a serious load, to be carried up great mountains by paths which to the uninitiated look only fit for goats.

And yet, on top of all this equipment the Italian soldier-mountaineer is required, on occasion, to take over parts of machine-guns, portable telephones, camp utensils, and other articles. Down below, in Aosta, pack-mules were loaded up in trains with the barrels of mountain howitzers; also with their wheels, separately, and certain shelter-tents, picks and shovels, and other implements. These hardy beasts are led as high as it is possible to take them, but the troops themselves venture up wild icy precipices of the Alps where not even a mule could find foothold. At a certain point, therefore, the pack-mules are unloaded and led down again to Aosta, after their loads have been distributed among the hardy troops, who shoulder their added burdens with a smile, grip the ashen shaft of their alpenstocks, and scramble up the precipices and almost perpendicular crags the best way they can. Sometimes the most daring among them will reach a point of vantage, and then lower a rope up which his fellows are to climb one by one. These soldier-mountaineers are the most wonderful rope-climbers I have ever seen in action. It is no small matter for a man to climb up a rope at all in the ordinary way; then what must it be when he is loaded with nearly sixty pounds' weight of equipment? Down at the barracks in the town, all recruits go through regular exercises in rope climbing, bearing the whole of their equipage.

The idea of the whole training is that one day it may be necessary to meet an enemy equally daring and skillful among these wild Alpine solitudes. For the French also have Alpine troops, and one may see these indulging in similar strange tactics on the colossal Mont Blanc itself. It is a fact that lightly-equipped French infantrymen, led by young officers, have gained the very summit of the giant of the Alps, which, as everyone knows, is nearly 16,000 feet high and is clothed in eternal snow!

All these soldier-mountaineers are crack shots; and it is difficult to see how one of the forts held by them amid the great granite bowlders and terrible pinnacles and spires of the Great St. Bernard could ever be forced by an enemy in the face of these troops, who would act as scouts, crawling up precipices, and planting themselves on wild and seemingly inaccessible spots, whence they would pour an invisible fire which nothing could withstand. These Alpine troops, when scouting or reconnoitering in the mountains, use a curious kind of rifle-rest, formed by three alpenstocks and one of the pillows they use at night when they sleep in the snow. For, strange as it may seem, these men when bivouacking at great altitudes do not trouble to put up tents, but merely dig out caverns in the vast snow-drifts, and line these with waterproof sheets and blankets, and there sleep amid dreary Alpine desolations as comfortably as though they were down on earth in a comfortable city bed.

The life of the men is magnificently healthy and exhilarating, as may be seen by the bright eyes, rosy cheeks, and clear complexions of a party of scouts that come glissading like lightning down the slopes of frozen snow on their long curving ski, guided and supported by the alpenstock. The troops also carry Arctic sledges for the transport of their "wounded"; and sometimes realistic demonstrations are given, when one or several men will lie at full length on these sledges and be dragged or glissaded over glacier and snowfield.

Much has been said and written about aerial warfare—I mean between airships provided with explosives. This may be a dream of the distant future, but nothing is more practicable than a clash between the Alpine troops of say France and Italy in the tremendous mountains of the Haute Savoie, many thousands of feet above the level of the sea. And just consider what that warfare would be! No cavalry, of course, no wheeled artillery; but only busy soldier-mountaineers clambering by ropes up dizzy precipices, hoping to pour their fire from a height.

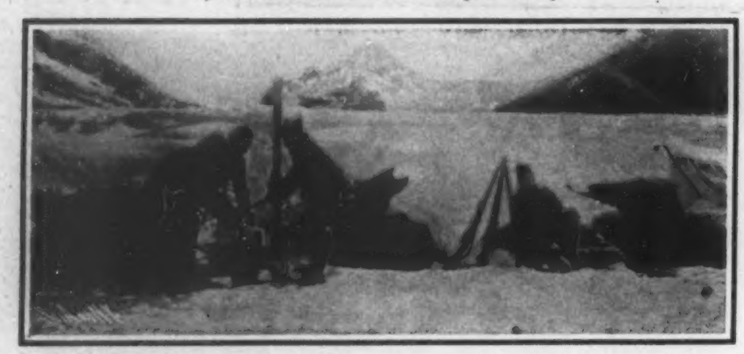
Officers, too, shouting commands through megaphones, or using the field telephones from rock to rock, and encouraging their men to carry up the mountain guns and open fire with these until the vast silent domes and sky-splintering peaks echo and re-echo with a thunderous roar that sounds sharp and clear, even above the rolling reverberations of the avalanche!

Sighting for a Long Shot.

A Squad of Italian Soldiers About to Cross the Pass of the Great St. Bernard on Skis.

Gymnastic Exercises of the Alpine Troops.

The Squad in the Picture Above This Crossing the Pass.



At Night Time Holes Are Dug in the Snow. In These the Men Sleep, Wrapped in Blankets.

How the "Wounded" Are Transported on Sledges by the Italian Alpine Troops.

Stray Scouts of the Italian Alpine Troops Glissading Down the Mountain Side on Skis Controlled by Their Alpenstocks.

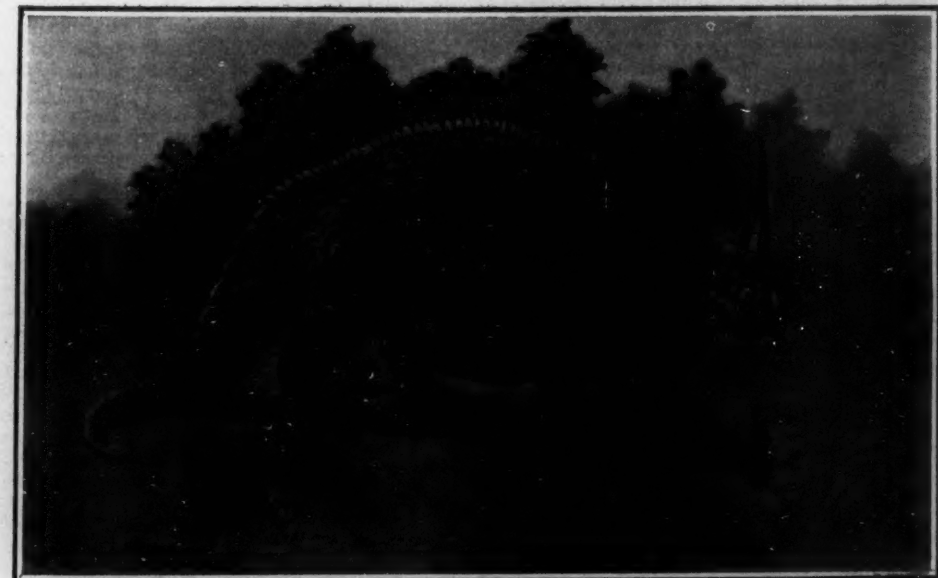
Climbing a Rope with All Accouterments is One of the Gymnastic Exercises of the Italian Alpine Troops.
The soldiers may fall into deep crevasses in active service, and only a rope can help them out.

THE SOLDIER-MOUNTAINEERS OF ITALY.

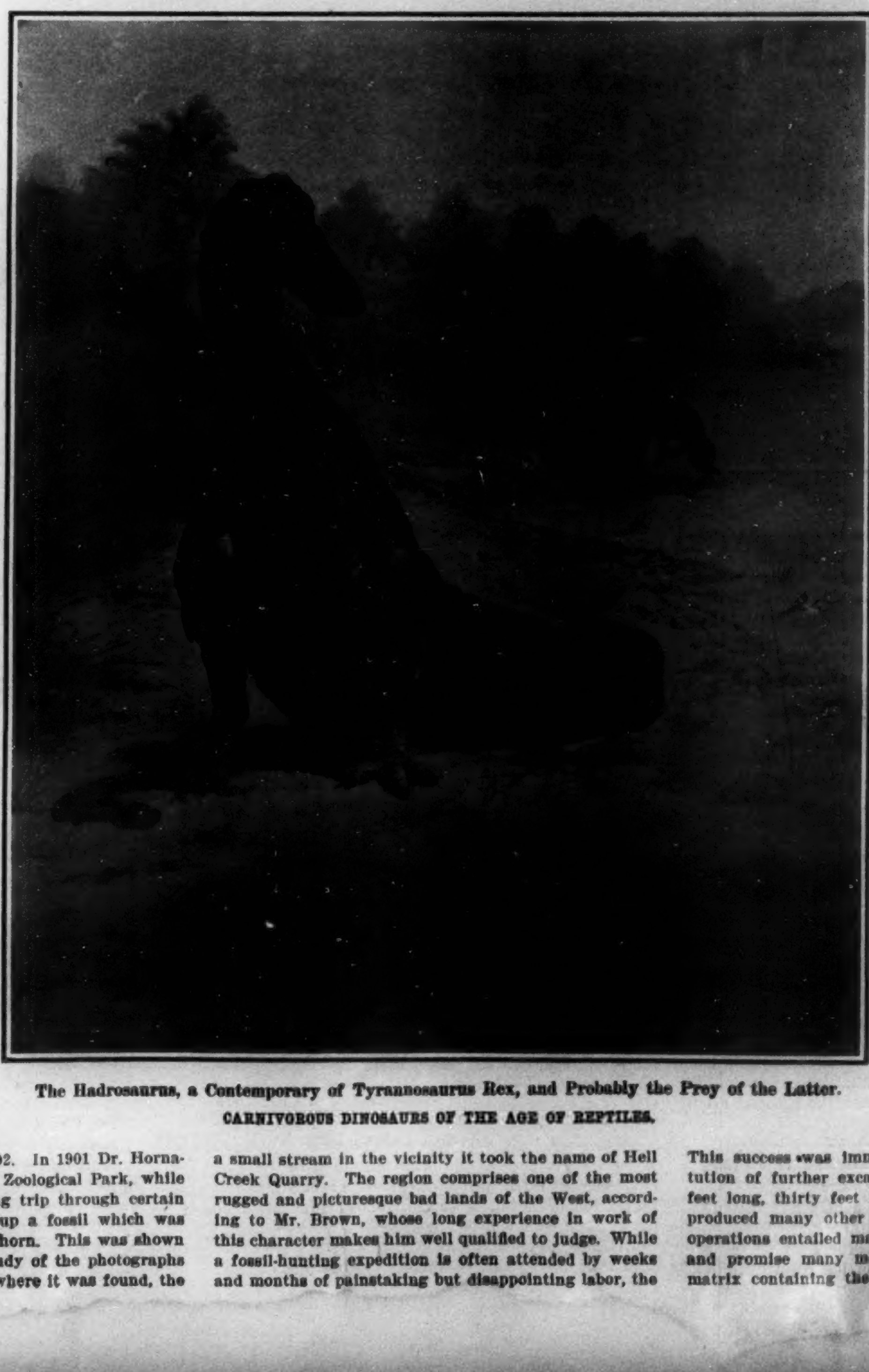
GIANT CREATURES OF PREHISTORIC TIMES.

While the vast prehistoric period characterized by the domination of great and small animals like, and yet exceedingly unlike, those with which we are acquainted is tremendously interesting, not only to the student of paleontology, but to the layman as well, that prior age, older and greater, wherein the reptilian order flourished is still more fascinating to investigate. As the major part of the creatures inhabiting the earth to-day are mammals, we feel more or less familiar with that order. With reptiles in general, however, the case is different, for the existent representatives have so hopelessly degenerated, or are so totally different from their Cretaceous, Jurassic, or Triassic ancestors, that the contemplation of many of these giant creatures arouses in the mature mind that same wonder with which a child receives its first fairy tale. And to the uninitiated the science of paleontology seems almost to deal with magic—a magic through the exercise of which we are enabled to gather from the study of a few fossilized bones, not only the probable size, form, characterization, and appearance, but the general habits and methods of life as well, of organisms that existed not thousands, but millions of years ago.

The advancement of paleontology in this country, and in general, is due in many particulars to the American Museum of Natural History of New York city. The readers of the SCIENTIFIC AMERICAN are familiar with one of these, the great Brontosaurus restoration, which was executed by the Department of Paleontology of that institution, and which at present is the center point of interest in the great Dinosaur Hall. Within a few months there will be added to the collection another mounted specimen of the giant saurians which, while inferior in size, is undoubtedly not less remarkable in its characteristics than the huge "thunder saurian" already on exhibition. This is one of the great carnivorous dinosaurs of the Upper Cretaceous or "Laramie" age; and as it greatly exceeds in size any known carnivorous land animal, Prof. Henry F. Osborn, Curator of the Department of Vertebrate Paleontology of the Museum, proposed to make this the type of a new genus, Tyrannosaurus. Thus the public has within recent weeks become quite familiar through the newspapers and periodicals with *Tyrannosaurus Rex*, or as the reporter delights to put it, King of Tyrant Saurians. It is not strictly correct to designate this fossil discovery as quite recent, for the first bones found were located during the summer of 1902. In 1901 Dr. Hornaday, Director of the New York Zoological Park, while on a hunting and photographing trip through certain bad lands of Montana, picked up a fossil which was later found to be a Triceratops horn. This was shown to Prof. Osborn, and after a study of the photographs of the characteristic bad lands where it was found, the importance of the discovery was deemed sufficient to warrant the sending of an expedition to this region. Accordingly, the American Museum dispatched a party to this part of Montana in the summer of 1902 under the leadership of Mr. Barnum Brown. The quarry was located about 130 miles northwest of Miles City, in Dawson County, on the old Max Siber ranch, and from a small stream in the vicinity it took the name of Hell Creek Quarry. The region comprises one of the most rugged and picturesque bad lands of the West, according to Mr. Brown, whose long experience in work of this character makes him well qualified to judge. While a fossil-hunting expedition is often attended by weeks and months of painstaking but disappointing labor, the instance in question was quite the reverse, for within a few hours the quarry had been definitely located, and after nearly eight millions of years of obscurity, *Tyrannosaurus Rex* was about to be haled forth into the light of scientific investigation.



The Triceratops, a Formidable Creature of the Age of Reptiles, Existing When Tyrannosaurus Rex Flourished and Thought to Have Been Preyed upon by That Giant Lizard.



The Hadrosaurus, a Contemporary of Tyrannosaurus Rex, and Probably the Prey of the Latter.

CARNIVOROUS DINOSAURS OF THE AGE OF REPTILES.

In September of 1902 the entire number of the bones in sight was removed from the sandstone hill wherein the quarry is situated, and it was then believed that all the fossils at that locality had been recovered. At present these, comparatively small in number, but formidable in size, are already on exhibition in Dinosaur Hall, and they include six great vertebræ, a small humerus—supposed to belong to this animal—portions of the skull and jaws, and the ilium, pubis, and ischium. The last three are the pelvic bones, which are separate in reptiles, while in the order Dinosauria the pubis and ischium were the two greatly developed, downwardly-projecting members which, supplied with pads of cartilage, were used to rest upon, as shown in the accompanying illustration of the Hadrosaurus, a contemporary of *Tyrannosaurus Rex*. The Triceratops, illustrated in another engraving herewith, was also a contemporary of Tyrannosaurus, and was, it is believed, together with the Hadrosaurus, the principal prey of the great carnivore.

The large illustration depicts two great reptiles struggling for supremacy. These are Dryptosaurs, which, while much smaller than Tyrannosaurus and of an earlier period, were in all probability exceedingly like the latter in habits and general appearance. The restoration is believed to be correct, though it is not thought that the animals ever exhibited such agility as shown, for none of the thousands of footprints of Dryptosaurus that have been examined is such as to warrant a conception of this character. The illustrations are after restorations by Charles R. Knight from among the large number which so excellently supplement the exhibition of paleontologic specimens at the Museum. We are indebted to the Department of Paleontology of the institution for permission to use the restorations in preparing these illustrations.

During the summer of 1905, a second expedition to the region of Hell Creek under Mr. Brown, while not sent ostensibly for that purpose, again made a number of excavations where the first Tyrannosaurus bones had been found, and at the very bottom of a four-foot cut a number of additional bones were discovered, including a large hip-bone from the same specimen. This success was immediately followed by the institution of further excavations, and a large cut thirty feet long, thirty feet wide, and twenty-five feet deep, produced many other portions of the skeleton. The operations entailed many weeks of labor in the field, and promise many more for the laboratory, for the matrix containing the bones, which were all on one

level, is a sandstone almost as hard as granite. The first nine feet of the cut were plowed and scraped out with the aid of horses; the remainder was removed by careful blasting. We can easily understand the extreme delicacy with which the latter operation must be performed, when we take into consideration the brittle nature of the fossils, the hardness of the surrounding concretion, and the frequently involved positions of some of the bones. In fact, it was impossible to remove many of the fossils individually, so the surrounding matrix was cut out in a block, leaving the segregation of the bones to the laboratory force. The largest block weighed 4,100 pounds, and it required fourteen days' labor to transport the same to the railway.

The discovery included so many representative portions of the skeleton of this great flesh-eating dinosaur, that its general appearance can be described with reasonable accuracy. Tyrannosaurus, when in the erect position which in all probability he habitually assumed, measured about 39 feet in length, and carried his head at a height of some 19 feet above the ground. Some doubt still exists about the possible size of the forearm. In the first collection made in 1902 there were a small humerus and a small femur associated with the Tyrannosaurus bones. The humerus was supposed to belong to Tyrannosaurus and the latter was restored with a short forearm like the Jurassic carnivores, but in the collection of this year there is a large bone thought to be a humerus, and in this case the entire character of the animal would be changed. The whole matter can be cleared up only by freeing these new bones from the inclosing rock. He was practically a biped, with an agile bird-like manner of locomotion. The huge feet, about four feet long and three feet wide, also show bird-like characteristics, with three enormous toes projecting forward, and one extending backward. The toes of all four limbs were provided with great tearing claws. Enough skull bones were found to determine all of the characteristics of the head, which was far larger and contained a greater brain than that of the sluggish Brontosaurus, and was provided with great, sharp-edged serrated teeth, some of which were six inches long. Supplied by nature with such weapons, we can easily imagine that Tyrannosaurus made life miserable for some of his more inoffensive neighbors.

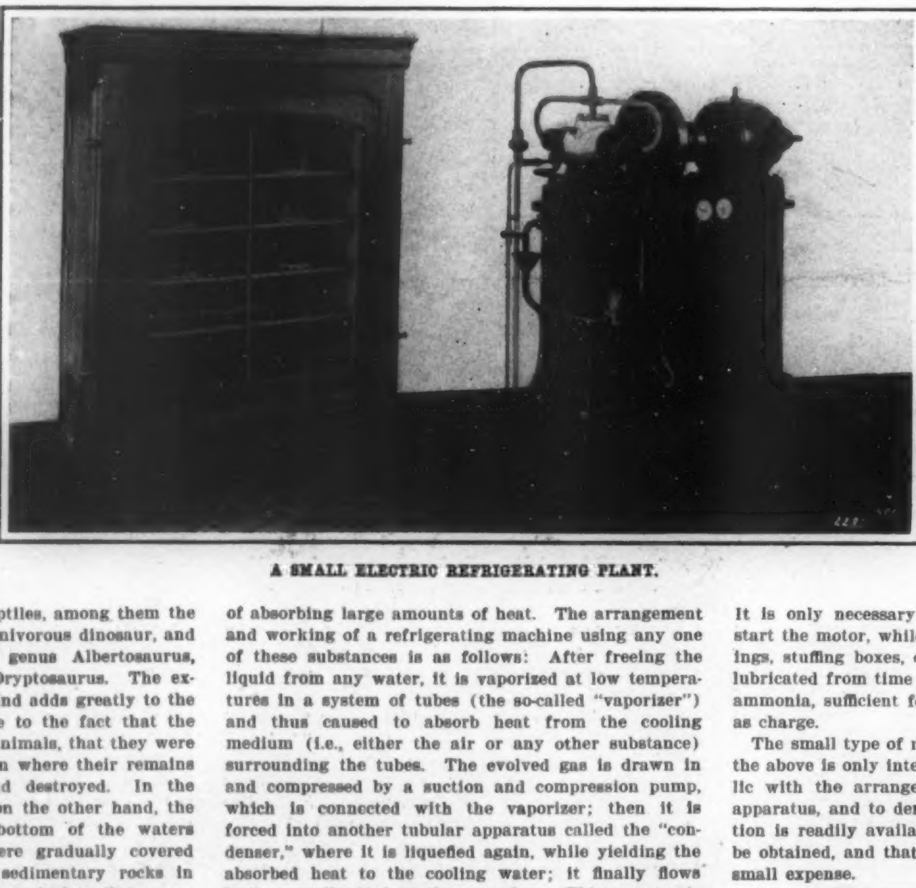
It is almost impossible to estimate the value of this find to the science of paleontology. It has already caused the reclassification of a number of the great denizens of the earth toward the end of the age of reptiles, among them the type Dynamosaurus, another carnivorous dinosaur, and the somewhat more primitive genus Albertosaurus, hitherto included in the type Dryptosaurus. The extreme rarity of fossils of this kind adds greatly to the value, a rarity undoubtedly due to the fact that the creatures were essentially land animals, that they were born, lived, and died in the open where their remains were speedily disintegrated and destroyed. In the case of amphibious Dinosaurs, on the other hand, the bodies usually settled to the bottom of the waters which they frequented, and were gradually covered over in the formation of the sedimentary rocks in which we find these fossils to-day. And so the preservation of individuals of the land species only occurred when the body accidentally became submerged in one of the waters of the region in which they lived. In three years' work carried on by the American Museum in the Cretaceous formations, parts of only three skeletons of this kind have come to light, one of these, an allied species of the same geological age, being found in Wyoming. From the traces of palms, rushes, and ferns, which are often found together with the bones of the Cretaceous period, the conclusion has been drawn that this region then possessed a sub-tropical climate, not unlike that of the West Indies of to-day. The region also included the great seas and lakes of salt or brackish water, the sedimentary remains of which are the bad lands of our age, the greatest fossil graveyards of the world.

REFRIGERATION WITH ELECTRIC MOTIVE POWER.

BY DR. ALFRED GRADENWITZ.

The most primitive and most extensively used processes of producing low temperatures are through the agency of melting ice. This is dependent on the following principle. The melting of ice requires a well-defined amount of heat, viz., 80 heat units or calories for each kilogramme at 0 deg. C. (32 deg. Fahr.), each calorie being capable of heating 1 kilogramme water (1.06 quarts) at 15 deg. C. (59 deg. Fahr.) through 1 deg. (1.8 deg. Fahr.). Now, as this amount of heat is derived by the ice from its surroundings, i.e., the air and other objects it comes in contact with, a *refrigerating* action will obviously be produced on the latter. This process of refrigeration is, however, affected by many disadvantages, the supply of ice primarily involving considerable expense, especially in the case of an extensive demand. There is also the nuisance connected with the moisture and dirt of the ice, and finally the space requirements of the outfit. Furthermore, this melting process does not allow the refrigeration to be carried below the temperature of melting ice, nor does it insure the dryness of the air, which is quite indispensable for a satisfactory preservation of food, etc., the melting ice producing a certain quantity of moisture in the cooling compartment.

Mechanical processes of refrigeration have therefore been resorted to of late years, using a method quite analogous to melting, viz., evaporation. When passing from the liquid into the gaseous state, a substance consumes a certain amount of heat termed *heat of evaporation*. As much as 536 heat units (calories) are thus required to convert 1 kilogramme of water at 100 deg. C. (212 deg. Fahr.) into steam of the same temperature under normal pressure. Now, the heat required for evaporation is derived from the surroundings of the body in the same way as in the case of the melting process, and these are consequently cooled down. Carbonic acid, ammonia, and sulphurous acid have been generally used as refrigerating agents in connection with vaporization processes, these substances being vaporized at low temperatures, while capable of absorbing large amounts of heat. The arrangement and working of a refrigerating machine using any one of these substances is as follows: After freeing the liquid from any water, it is vaporized at low temperatures in a system of tubes (the so-called "vaporizer") and thus caused to absorb heat from the cooling medium (i.e., either the air or any other substance) surrounding the tubes. The evolved gas is drawn in and compressed by a suction and compression pump, which is connected with the vaporizer; then it is forced into another tubular apparatus called the "condenser," where it is liquefied again, while yielding the absorbed heat to the cooling water; it finally flows back as a liquid into the vaporizer. This process is thus a cyclic one, wherein the refrigerating liquid is used over and over again, so that only the amount of energy required to drive the pump and the necessary cooling water is used up.



A SMALL ELECTRIC REFRIGERATING PLANT.

The refrigerating apparatus proper or vaporizer is located either directly in the compartment to be cooled (this being called direct vaporization) or in a reservoir containing a liquid congealing at a low temperature, e.g., a salt solution, which on being cooled down to the required temperature is in turn conveyed by a special pump through the refrigerating compartment and back into the reservoir (this being the process of indirect vaporization). The latter alternative possesses the advantage that it allows of a local concentration of the process and of storing cold in the cooled brine, so that the refrigerating effect is maintained for some time even after the plant has been out of service. Accordingly this process is especially used in the case of permanent refrigeration of extensive rooms for cooling at longer distances or else for the production of ice on a large scale.

The advantage of artificial refrigeration over the cooling by ice may be excellently demonstrated in the case of two identical cultures, one of which had been exposed to an ice refrigeration compartment and the other in a mechanical cooling plant. Whereas a whole colony of micro-organisms had been evolved in the former, the culture being partly consumed by putrefaction fungi, the latter at most shows only small traces of inoffensive mold, thus illustrating the efficient results of mechanical refrigeration.

While this process of refrigeration, which in many cases is utilized in the manufacture of ice, has been generally introduced in large plants, ships, etc., it has been impossible up to the present to use it economically on a small scale or to introduce it into general practice. The type of apparatus illustrated herewith has been constructed for this purpose jointly by the Berlin Electricity Works and the Gesellschaft für Linde's Eismaschinen. This electrically-driven refrigerating machine, which is being exhibited at present at the permanent electrical exposition of the Electricity Works, will be particularly welcome to architects and builders, for the installation of cooling plants in villas, dwelling houses, etc.

The ammonia refrigerating machine includes a horizontal compressor, consisting of two single-action cylinders with a plunger piston driven from a common crankpin and running in an oil bath. This machine is directly operated by a 1.3-horse-power A. E. G. motor mounted with it on the same foundation plate. The condenser, where the vaporized liquid is reconverted into the liquid condition, is located in the iron supporting casing, wrought-iron serpentines being provided for the admission and discharge of the cooled water. The vaporizer is located in a cooling compartment shown in the photograph; but as the apparatus is intended for demonstration purposes only, its dimensions do not correspond to the full output of the machine. There is furthermore an isolated vaporizer beneath the motor for the case of the indirect process referred to above. In this event a small circulation pump would have to be added to the mechanism. The output of the machine is about 1,000 calories per hour with a gas temperature of —10 deg. C. in the vaporizer and a speed of 400 R.P.M., the corresponding consumption of energy being about 900 watts. In order to illustrate the significance of these figures, it may be said that this amount of heat would be sufficient to cool about 150 cubic meters of air per hour from 20 deg. down to 0 deg. C., irrespective of its moisture.

After the apparatus has been prepared for operation, its manipulation will be found extremely simple. It is only necessary to turn on the cold water and start the motor, while any friction parts, such as bearings, stuffing boxes, etc., should of course be properly lubricated from time to time. About 3 kilogrammes of ammonia, sufficient for a considerable period, are used as charge.

The small type of refrigerating machine described in the above is only intended to acquaint the general public with the arrangement and operation of such an apparatus, and to demonstrate that artificial refrigeration is readily available wherever electric current can be obtained, and that it can be secured at a relatively small expense.

Poisonous Effects of Eggs.

L'Illustration recently published the following curious facts:

"Should we think that eggs possess a poison? That nevertheless is what M. G. Loisel declares. But we must understand each other. Eggs are poisonous in certain conditions merely, when we absorb them in a certain way. They are poisonous when injected beneath the skin, and no one thinks of applying them in that way. It is the yolk chiefly that is poisonous. The poison varies according to the species that provided the egg. The duck's egg kills the rabbit in a dose of 8 cubic centimeters; that of the hen kills only in a larger dose. By way of compensation, the turtle's egg is more noxious than that of the duck: it kills in a dose of 5 or 6 cubic centimeters. Therefore the turtle is more poisonous than the duck, and this last is more so than the hen. Rabbits poisoned by the yolk of an egg injected under the skin or into a cavity of the body die with the symptoms of an acute intoxication of the central nervous system. The white also of the turtle's egg is very poisonous. But none of these eggs is hurtful when absorbed by the digestive organs."

NEW AUTOMOBILE SPEED RECORDS IN FLORIDA.

The annual speed trials and races which have been held for the last three years at the Ormond-Daytona Beach, Fla., were run off last week under rather unfavorable weather conditions; but nevertheless they resulted in the complete triumph of a steam racer built by the originators of the steam automobile in America, the Stanley Brothers, of Newton, Mass. This machine not only made a reduction of 9 4-5 seconds in the record for a steam machine, but it also made the fastest time (2 min. 47 1-5 sec., or 108 m. p. h.) in the five-mile race when run against the speediest cars that Europe can produce.

The new record of a mile in 28 1-5 seconds was made on January 26, in the mile trials. This is equivalent to a speed of 127.65 miles an hour, and is only 2¾ miles an hour less than the fastest speed (130.4 miles an hour) ever made on rails, which was accomplished by an electric car near Berlin, Germany, in November, 1903.

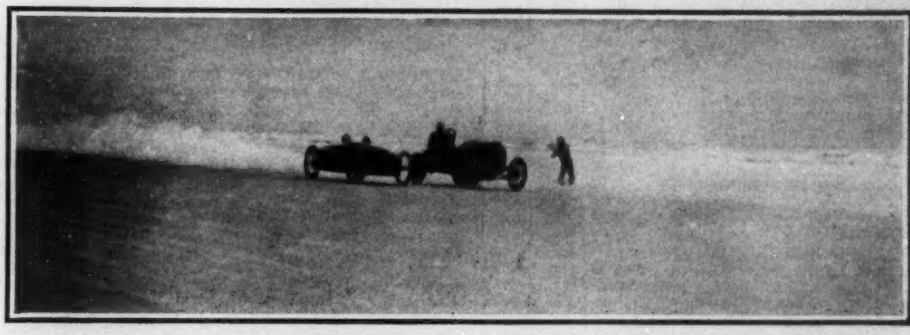
In competition with the steam machine in the one-mile trials were a special 8-cylinder, 200-horse-power Darracq racer, the 100-horse-power Napier (which made a record of 34 2-5 seconds for this distance last year), a 110-horse-power Fiat, and a 100-horse-power Ford. The nearest approach to the figures set by the steam machine was made by Chevrolet with the 200-horse-power Darracq, who covered the mile in 30 3-5 seconds, or at a rate of 117.64 miles an hour. This stands as the new record for heavy-weight gasoline machines. The Napier did not equal its performance of last year, requiring 37 2-5 seconds for the mile. Cedrino's Fiat made the distance in 36 3-5 seconds, while the Ford machine made it in 40 seconds, or at 90 miles an hour.

The mile record of 57 1-5 made by a 20-horse-power light-weight, double-opposed-cylinder Stevens-Duryea machine last year was reduced to 52 3-5 seconds by a 32-horse-power Reo racer of the same type. The new record is equivalent to a speed of 68.44 miles an hour. The cars which were second and third were a 45-horse-power Wayne (time 1 m. 6 s.) and a 12-horse-power Maxwell (time 1 m. 29 2-5 s.)

The speed trials over a distance of one kilometer (0.621 mile) were also won by Marriott in his 50-horse-power Stanley steamer in 18 2-5 seconds, or at a rate of speed of 121½ miles an hour. This is 5 4-5 seconds faster for this distance than was made by a similar machine last year, and 4 3-5 seconds faster than the best previous record, which was 23 seconds, made by McDonald in a Napier machine last year. Chevrolet succeeded in driving the 200-horse-power Darracq a kilometer in 19 2-5 seconds, which was about a second better than this machine did a month ago in France in making its first speed trials. The 100-horse-power Napier car covered a kilometer in 21 3-5 seconds, and the 110-horse-power Fiat in 22 4-5.

Other events which were run off on January 26 were a 10-mile middleweight championship, which was won by Vaughan on a 80-horse-power Darracq in 7 m., or at a rate of speed of 85.7 miles per hour, and a 10-mile Corinthian handicap, which was won by Harding on a 45-horse-power Daimler (having 3½ minutes handicap) in 8 m. 48 4-5 s., with a scratch car—an 80-horse-power Darracq—second in 6:42 4-5, which is equal to 89.37 miles an hour.

The first record-breaking performance of the Stanley steamer occurred on January 23, when it covered a mile in 31 4-5 seconds, and thus reduced by one second the record made last year by an 8-cylinder Mercedes machine, which was over the specified weight of 2,204 pounds, and the record of which consequently did not stand. This first record mile was made in the afternoon subsequent to a drizzling rain in the morning, and the result was that the beach was not particularly fast, nor were the weather conditions of the best. The first record mile, which is equivalent to 113.2 miles an hour, was made subsequent to the winning of the International Dewar trophy, given for a one-mile race in three heats. The first and third heats of this race were won by the steamer in 32 1-5 and 32 seconds respectively, while the best time by a gasoline machine in this race was made by Lancia with a 110-horse-power Fiat, which won the second heat in 37 3-5 seconds. It will be recalled that a Stanley steamer also won the Dewar trophy last year in 41 1-5 seconds, which was but 3-5 of a second faster than the time made by a Napier machine. So sanguine is Mr. Stanley of lowering the record still more, that he has contracted to build a new machine which will do a mile in 25 seconds, or at a rate of speed of 144 miles an hour. As can be seen in the illustration, the new Stanley machine is built on much the same lines as the racer used last year. The body resembles a boat with a rounding deck, while that used previously was more the shape of a torpedo. The power plant is much the same as heretofore, and the Stanley method of construction, with a horizontal engine and spur gear drive, is employed. It is needless to say that very high pressure is employed in the boiler, which is of the usual water-tube type. Not only did the racer succeed in beating all the gasoline cars in its class in distances up to 5 miles, but a smaller machine consisting of a standard chassis also won a 15-mile handicap race in 13 m. 42 2-5 s., or at a rate of speed of 65.7 miles an hour.

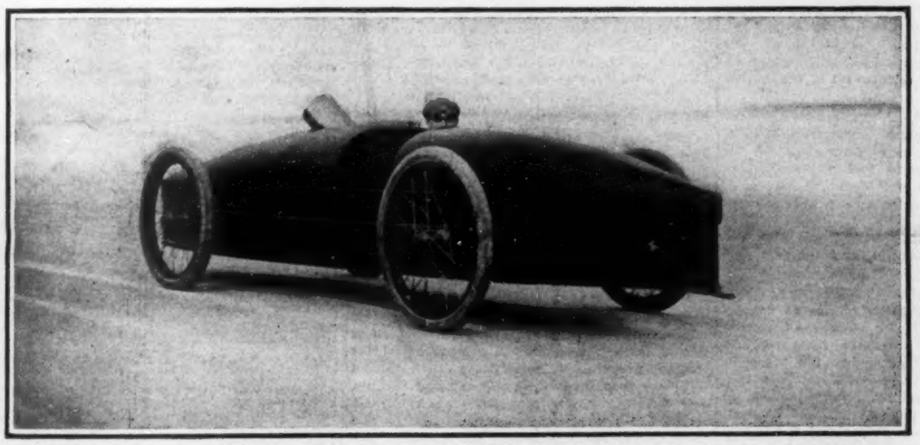


Marriott in the Stanley Steamer Pressing Lancia on His 110-Horse-Power Fiat Closely in the One-Mile Race for the Dewar Trophy.

The Stanley won the first and third heats in 32⅕ and 32 seconds respectively. The second heat was won by the Fiat in 37⅗ seconds.

The huge 8-cylinder car, which we illustrate, was specially designed and built by a noted French automobile engineer, for the purpose of breaking records at the Ormond meet. The machine is rated at 250-horse-power. It has a duplex carbureter and spark plugs in the head and side of each cylinder. The power of its engine is so great that the clutch could not transmit it, and the machine from various other causes was unable to run successfully in any of the races. Another machine which was finished at the last moment and shipped to Florida in the hope of breaking records was a 100-horse-power Christie direct-drive car. Trouble is said to have developed in the cylinders of this machine, and while practising one day on the beach it ran into a piece of wreckage, smashing the front wheel. It is to be hoped that the Christie car which, we understand, has been repaired, will be able to run in some of the longer races.

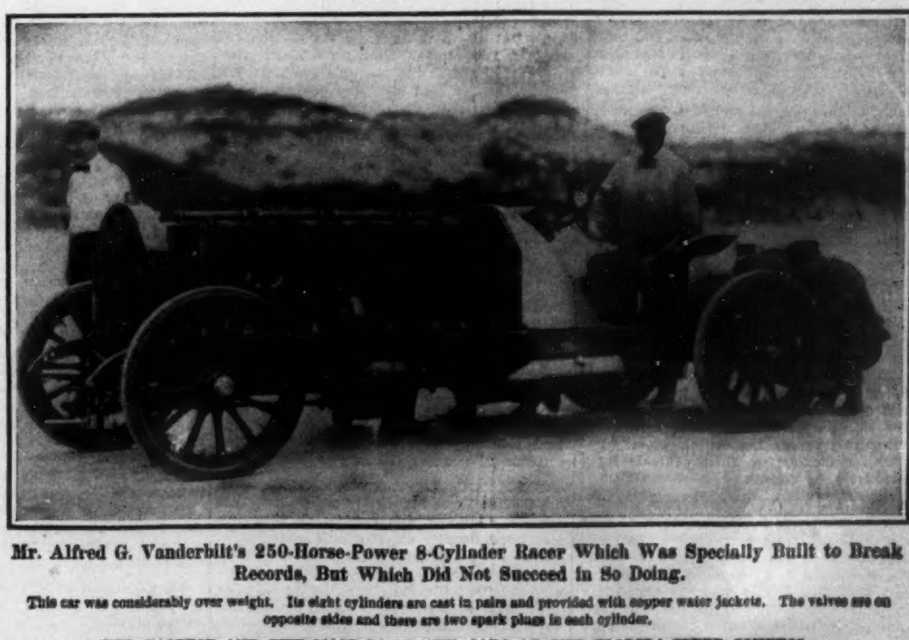
The great reductions which have been made in time for the mile and for longer distances, make it impossible to prophesy where the craze for speed will end. While two miles a minute—the mark set for a gasoline machine of not over 1,000 kilogrammes (2,204 pounds weight)—seems to be about the limit with a gasoline machine, a specially-built steam car of this weight will probably be able to reach as high a speed as 150 miles an hour over a distance of one mile. That this record will soon be attained does not seem an improbability, in view of the great increase in speed shown by a special type of steam racer within the brief space of one year.



The 50-Horse-Power Stanley Record-Breaking Racer Which Traveled a Mile in 28⅕ Seconds at the Remarkable Speed of 127.65 Miles an Hour.

Germination of Orchid Seeds.

When the seeds of orchids are sown, especially those of the Cattleyia or the Lælia, it is found that the germination, which is quite irregular, is accompanied with the presence at the extremity of the plantule of a cluster of filaments due to an endophyte fungus. Recent experiments of the French scientist, M. Noel Bernard, have shown that the presence of this fungus is indispensable to the germination of the orchid seed. If the seeds are asepticized, they will not germinate; but if they are put in a pure culture of the fungus, the mycelian filaments of the latter penetrate the embryo; then the germination commences, and is pursued regularly. This observation shows a distinct case of normal parasitism, in which an organism cannot be developed without the penetration of a parasite.



Mr. Alfred G. Vanderbilt's 250-Horse-Power 8-Cylinder Racer Which Was Specially Built to Break Records, But Which Did Not Succeed in So Doing.

This car was considerably over weight. Its eight cylinders are cast in pairs and provided with copper water jackets. The valves are on opposite sides and there are two spark plugs in each cylinder.

THE FASTEST AND THE MOST POWERFUL CARS AT THE FLORIDA SPEED CONTEST.

RECENTLY PATENTED INVENTIONS.

Of General Interest.

FRAME FOR HOLDING AND STRETCHING FABRICS.—M. A. WEATHERS, Manchester, N. H. In this invention the reference is more especially to frames for holding fabrics employed in the making of mats, rugs, quilts, and similar articles and for stretching such fabrics and others—as, for instance, lace curtains, women's face-veils, and the like—for drying the same after cleaning. It is readily adjustable to fabrics of different sizes or dimensions.

BOX-OPENER.—C. GOLDMANN, New York, N. Y. It may be stated that the improvements are especially adapted to pasteboard and paper boxes of rectangular structure, and the inventor employs opening devices for the box which normally may be also utilized as bails or handles for carrying the box when filled, said devices being so organized with reference to opposite sides of the box as to enable the sides to be torn from the remaining sides in such manner as to enable the contents to be removed in intact form.

REGULATING-HINGE FOR PIANO SWINGING FRAMES.—I. E. BRETZFELDER and R. K. THUMLER, New York, N. Y. One purpose of the inventor is to provide a construction of hinge adapted for connecting the fixed skeleton frame of the instrument with the swinging frame or panel which supports the book or sheet of music above the keyboard, the hinge being of such construction that the pintle may be removed when the parts of the hinge are to be separated, thus obviating the withdrawal of the screws, and wherein the pintle will remain in the position in which it is adjusted until purposely withdrawn.

CLOTHES-TONGS.—F. L. BLOMQUIST, Sanders, Idaho. Stated in general terms, the object of the invention is to provide a device which is simple, light, strong, inexpensive and durable, and which may be more conveniently used in handling clothes in the process of washing than other devices of similar character. The device is made of hard wood for the sake of lightness. The absence of hinges, springs, or other connecting devices make it impossible for the tongs to catch in the garments handled and tear them.

COMBINATION-TOOL.—E. J. LA DUKE and I. G. O'HARRA, Seattle, Wash. The invention has reference to measuring instruments such as used by artisans and handicraftsmen in laying out work. The tool is expected to be especially useful to the carpenter's trade. The object is to produce a tool which will be, in effect, a combination of a rule, try-square, bevel-edge, calipers, and dividers.

LAMP-BURNER.—E. ROSS and J. A. BOYLES, Lynch, Neb. One of the purposes of this invention is the provision of a burner with a combined air and gas relief tube having such relation to the outlet end of the wick-tube that all of the gas and air will be extracted from the container as fast as generated therein and be fed to the flame and consumed without smothering the flame, thereby eliminating every possibility of the lamp exploding, though either gasolene or a poor quality of kerosene be used.

CRANE.—G. E. SOPER, Kankakee, Ill. Mr. Soper's invention relates to small cranes or hoists such as used in machine-shops, foundries, and similar places for raising and moving heavy machine parts. The object is to produce a crane of this class which is simple in construction, composed of few parts, and which will have a desirable resiliency when supporting its load.

STOCK-COLLAR DISTENDER.—G. V. TUCKER and E. B. AIGUIER, Newark, N. J. This invention pertains to improvements in devices for distending vertically and supporting so-called "stock-collars" worn by women, the object being to provide a device for this purpose of simple and novel construction for detachable connection with the stock and used in lieu of whalebones, wires, or the like, so that after removing the distenders the stock may be readily washed or otherwise cleaned.

FURNACE.—G. WATSON, Pool, near Leeds, and H. W. MASON, Wakefield, England. The present invention has reference to furnaces, and more particularly to those adapted for the destruction of refuse. Its principal objects are the provision of efficient means for furnishing a forced draft to the furnace, means for protecting the metal parts from burning out, and also the provision of a convenient ash-pit.

SYSTEM FOR THE DESTRUCTION OF REFUSE.—G. WATSON, Pool, near Leeds, and H. W. MASON, Wakefield, England. This improvement has reference to systems for destroying street and house refuse and the like, and more particularly to those in which the material is delivered to furnaces in bulk. Its principal object is to provide an effective system for this purpose. Instead of delivering the refuse to furnaces the containers may be employed for discharging their contents into other receivers, as vessels.

UMBRELLA.—J. C. WESTERFIELD, Belleville, N. J. The more particular object of the inventor is to produce a construction in which certain parts are easily replaced and in which friction is reduced to a minimum. It further relates to certain details whereby simplicity and cheapness are attained in the construction. With parts in position it is used as any other umbrella. Should a rib or stretcher be worn out or broken, it may readily be removed and another inserted. Spiders, set-screws, and other parts are interchangeable.

HORSE-COLLAR.—J. DE W. WHIPPLE, Tekamah, Neb. In this patent the invention relates to improvements in draft-collars for horses, an object being to provide a collar that will readily adapt itself with yielding pressure to the neck and shoulders of an animal and practically prevent the formation of sores, as often happens, from abrasions with the usual form of collars.

PASTING DEVICE.—H. H. WALKER, Ponca, Oklahoma Territory. This pasting device is especially adapted for use in offices and similar places for applying paste to the edges of papers to be attached together. The object is to produce a simple attachment for paste pot or tubes which will enable the paste to be applied quickly to the edge of the paper and neatly, so as to prevent soiling of the fingers.

METHOD OF MANUFACTURING SIDING.—C. LOETSCHER, Dubuque, Iowa. In this case the invention refers to a siding or weather board used for the outside covering of frame buildings and to a method of manufacturing the same. The objects are to provide for a more economical production of sidings and at the same time to provide a siding-board having certain points of superiority over those in use.

HOOK.—LORA JONES, Newton, Kan. This invention relates to hooks, such as are used in connection with eyes for the purpose of fastening the edges of a garment together, the hooks being secured along one edge and eyes along the other of such garments, and adapted to be interlocked in a well-known manner. The object is to provide means whereby a hook may be secured to the edge of a garment at a point upon the shank removed from the usual thread-eyes.

MAIL-POUCH FASTENER.—L. H. HINAMAN, Port Jervis, N. Y. In operation the flap is drawn down upon staples and the strap pulled to the left, moving all the locking-bolts into engagement with the respective staples. The strap may be secured by a padlock, or the bolt of the end of the lock may be locked by a key. To open the pouch, simply remove the padlock or unlock the end lock, when a pull on the strap of the latch releases all of the staples simultaneously.

BOTTLE-CLOSURE.—J. HERRINGTON, Houston, Texas. This improvement refers to a class of bottles used as original packages for various kinds of liquors and medicines, and has for its object to provide novel details of construction for a bottle and closure thereof which will expose an attempt to refill it after its contents have been removed, and thus prevent the reuse of the bottle for fraudulent purposes.

SHADE-FASTENING.—F. WEILERT, New York, N. Y. The invention relates to devices for fastening the shade-cloth to a shade-roller; and its object is to provide a fastening and means for conveniently placing the same in position or removing the same from the shade-roller, the shade-fastening being simple and durable in construction, easily placed in position, and arranged to securely attach the shade-cloth to the shade-roller.

CONTROLLING-VALVE.—P. VOORHEES and H. J. TRAH, Logansport, Ind. This improvement pertains to valves for controlling the flow through various conduits, it being particularly applicable to the rain-water conductors of buildings. The principal object is to provide means for directing to waste the first flow through the conductor at the beginning of a rainfall, this being liable to be fouled by dirt accumulated upon the roof and in the gutters, and then automatically delivering a succeeding flow to the cistern or other container which is to receive it.

MEANS FOR RELEASING BOATS FROM THEIR FALLS AT BOTH ENDS SIMULTANEOUSLY.—G. S. A. RANKING, 17 Elysium Row, Calcutta, India. This invention relates to a device whereby a boat may be released from its falls at both ends simultaneously, the entire device being under the control of one man. To release the boat from the falls the handle is rotated, which action causes the cams to rotate simultaneously, and thus remove the support of the rollers which immediately drop into position, causing the hooks to be disengaged. To replace the hooks in first position, the handle is turned back into its place, causing the lower edge of the sloping portion of the cams to engage the rollers, which are raised back into position.

DEVICE FOR HANGING AND CENTERING GRINDSTONES.—J. H. NORRELL, Augusta, Ga. In this patent the invention has reference to an improvement in hanging and centering a grindstone on its frame, its object being to produce a simple, cheap, and efficient device. Primarily intended for use in connection with grindstones, it is equally applicable to emery-wheels or even pulleys which are to be rotated by means of treadles and pitmen.

AUTOMATIC LEVEL-CONTROLLER.—L. NEU, 60 Rue Brule Maison, Lille, France. This invention relates to a device intended to produce the automatic starting and stopping of apparatus for forcing liquids or other fluids, such as water-raisers, gas-compressors, and the like. The invention has for its purpose an operation in such a manner that the distributing member or the clutch when once started in one direction or the other shall be obliged to complete its movement rapidly and shall not be capable of remaining at the half-stroke.

NON-REFILLABLE BOTTLE.—H. W. LLOYD, Longbranch, N. J. The main object in this case is to provide means for preventing the refilling of the receptacle after it is once emptied. This is accomplished by the use of a stopper, and Mr. Lloyd preferably uses a plurality of these devices and provides means whereby the stopper in a folded condition can be introduced and means for automatically unfolding the stopper after it is introduced and released in the neck of the bottle, the first named means operating to prevent the removal of the stopper after it is unfolded or expanded.

ATTACHMENT FOR STORE-COUNTERS OR THE LIKE.—P. S. GRINDLE, Brooklyn, Ala. One of the principal objects of the inventor is to provide a structure adapted to be rotatably mounted beneath a counter, shelf, or other support within a store or other place whereby a barrel or box containing sugar, flour, coffee, or the like, may be conveniently stowed away beneath the counter at such times as access thereto may not be desired and which may be readily swung outwardly in convenient position whenever access is desired either to supply customers or for other purposes.

APPARATUS FOR MIXING PAVING COMPOSITIONS.—G. W. CRICHFIELD, Jersey City, N. J. In attaining the ends of this invention there are provided peculiarly-constructed receptacles in which the asphaltic material and mineral aggregate are charged and by which they are heated uniformly, this heating being effected by means of steam pipes, and the pressure, and therefore the heat of the steam-pipes, controlled in such a way as to render it impossible to overheat the materials. The heating-receptacles are arranged to discharge into peculiarly-arranged weighing vessels, which themselves discharge into the mixer where the various materials are united to form the paving composition.

ANIMAL-TRAP.—G. J. MILLER, Endicott, Wash. The improvement is in that class of traps which have spring-actuated bows or jaws adapted to be set in a retracted position and when released to snap down upon the animal's body. It is peculiarly adapted when made of small size for catching moles. It is an improvement upon the trap for which Mr. Miller formerly received Letters Patent.

ADJUSTABLE TABLE.—C. H. GARDINIER, Rensselaer, N. Y. The improvement pertains to that class of articles of manufacture which may be used for various purposes, such as drafting-tables, sewing-tables, type-writer desks, studying-tables, china painters' tables, sick-room tables, artists' easels, etc. It is collapsible, folds into a small space, and is adjustable to various heights and angles.

Household Utilities.

WINDOW-SHADE FIXTURE.—G. C. VERGASON, Binghamton, N. Y. An object of this improvement is to provide a fixture which is adaptable to window-frames of varying widths without marring or mutilating the exposed faces thereof, besides being strong and durable, and light in weight. The parts are easily assembled for use and again dismantled and taken apart for shipment. Mr. Vergason employs duplicate hangers of special construction, combined with portions of which are adjustable slides, rigid with which are brackets to which are secured the outer extremities of a specially-constructed expansible device for the brackets.

FLUSHING DEVICE.—P. L. GUEST, Columbus, Ga. One of the principal objects of the inventor is to avoid the use of the movable siphon. A stationary siphon is provided, and a regulating device for the inlet-valve of the tank is so arranged as to provide for shutting off the inlet when the water reaches a certain height and before the siphon commences to operate. Means provide for releasing inlet-valve, so as to admit water upon manipulation by hand. Then water rises and starts the siphon, and when water is removed from tank through siphon the inlet-valve is again engaged so that further introduction of water will automatically close the valve in same position as before.

HOLDER.—A. E. MARTIN, Toledo, and R. W. KENNARD, Fernhill, Wash. In the present patent the improvement has reference to holding devices, and more particularly to those adapted for culinary use to support upon a kettle or other vessel its lid and a spoon or the like. The invention has for its principal objects the provision of a simple, strong and very efficient holder.

Machines and Mechanical Devices.

CONVEYER.—G. LUCAS, Passaic, N. J. In this patent the invention relates to conveyers, it having for its principal object the provision of a simple and durable apparatus which will effectually transport material. The improved conveyer furnishes an unbroken conduit of considerable depth, by which many kinds of material may be moved from one point to another, and the flexible fabric which constitutes the conveyer proper is so supported that it may carry great weights without sagging and yet readily adapts itself to changes of direction.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**
MUNN & CO.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 7777.—Wanted, the name and address of the manufacturers of the Babcock milk tester.

For hoisting engines. J. S. Mundy, Newark, N. J.

Inquiry No. 7778.—For makers of cheap electric pocket lamps, and small electric novelties.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 7779.—Wanted, a water still, of capacity of 100 gallons daily.

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 7780.—For manufacturers of blowers.

WANTED.—Purchaser for Monasite, Molybdenite and Wolfram. Apply Monasite, Box 773, New York.

Inquiry No. 7781.—For makers of vulcanizers, rubber stamps, and supplies for same.

I sell patents. To buy, or having one to sell, write Chas. A. Scott, 719 Mutual Life Building, Buffalo, N. Y.

Inquiry No. 7782.—Wanted, Bowe's quick-opening hose couplings.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Machine Company, Foot of East 138th Street, New York.

Inquiry No. 7783.—For makers of bottling machines; also for information regarding the manufacture and bottling of carbonated drinks.

WANTED.—Ideas regarding patentable device for water well paste or mucilage bottle. Address Adhesive, P. O. Box 773, New York.

Inquiry No. 7784.—For makers of saw machines, or saw mills for squaring small timbers, from 1 inch up to 8 inches.

WANTED.—High-class machinists and tool makers. Good wages. No labor troubles.
Driggs-Seabury Ordnance Corporation, Sharon, Pa.

Inquiry No. 7785.—For makers of luminous paint.

Well gotten up typewritten letters will increase your business. $2 per 1,000.
Typewritten Letter Co., St. Louis.

Inquiry No. 7786.—For makers of small castings cast in metal moulds, to exact size.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machinery tools and wood fibre products. Quadriga Manufacturing Company, 18 South Canal St., Chicago.

Inquiry No. 7787.—For makers of sewing machine needle-threaders, having a flange on both sides.

Inquiry No. 7788.—For manufacturers of gas-making machinery, for illuminating purposes.

Inquiry No. 7789.—Wanted, addresses and catalogues of companies manufacturing small dynamos.

Inquiry No. 7790.—For manufacturers (in Canada) to undertake the manufacture of a candy holder.

Inquiry No. 7791.—For makers of brass trimmings for gosoline launches, etc.

Inquiry No. 7792.—Wanted, makers of leaded glass windows and doors.

Inquiry No. 7793.—Wanted, a machine, patented by Mr. Christian Rotts, for cracking off lamp chimneys and tubular glassware.

Inquiry No. 7794.—For manufacturers of electrical fixtures and fittings.

Inquiry No. 7795.—For parties to roll out semi-circular troughs, of half-inch steel plates.

Inquiry No. 7796.—Wanted, a flutter wheel, 3 inches diameter, to keep in motion by means of a spring.

Inquiry No. 7797.—Wanted, makers of engines using coal oil for fuel, instead of gasoline.

Inquiry No. 7798.—For makers of trunks, etc.

Inquiry No. 7799.—For dealers, in large quantities, of palm leaf fans.

Inquiry No. 7800.—For makers of electrical toys, induction coils and Geisler tubes.

Inquiry No. 7801.—Wanted, machines to make ladies' hat and bonnet wire frames.

Inquiry No. 7802.—Wanted, the most recent and improved machinery for manufacturing roofing tiles.

Inquiry No. 7803.—For makers of small refrigerators.

Inquiry No. 7804.—For makers of horseshoe magnets.

Inquiry No. 7805.—For small pocket mirrors.

Inquiry No. 7806.—For makers of farm-gate hangers, gate hangers and hinges.

Inquiry No. 7807.—For makers of printing plates, which may be mailed.

Inquiry No. 7808.—Wanted, metals for experimental use.

Inquiry No. 7809.—Wanted, bleached or unbleached horsehair for manufacturing purposes.

Inquiry No. 7810.—Wanted, machinery for modern canning factory.

Inquiry No. 7811.—Wanted, machinery for making and printing tags.

Inquiry No. 7812.—Wanted, makers of chemical apparatus and chemicals.

Inquiry No. 7813.—Wanted, makers of artificial eggs.

Inquiry No. 7814.—For manufacturers of aluminum.

Inquiry No. 7815.—For makers of fancy labels for perfume bottles, etc.

Inquiry No. 7816.—For makers of zinc white and dry colors.

Inquiry No. 7817.—Wanted an automatic device for lifting sewerage from low level to a height.

Inquiry No. 7818.—Wanted, makers of air tools for boiler work.

Inquiry No. 7819.—Wanted, names and addresses of manufacturers of gas from gasoline or other oils.

Inquiry No. 7820.—For makers of chuck perforators and other such devices.

Inquiry No. 7821.—Wanted, the name and address of the maker of the "Crown Press," having cushioned bed plates and using rubber type, for addressing envelopes, printing bill and letter heads, etc.

Inquiry No. 7822.—Wanted, a device for striping carriages, etc.

Inquiry No. 7823.—For makers of and dealers in electric furnaces.

Inquiry No. 7824.—Wanted, the necessary apparatus, etc., for fitting up an office for therapeutic and X-ray work.

Inquiry No. 7825.—For makers of looms for weaving raw material, such as mohair, into saddle blankets.

Inquiry No. 7826.—Wanted, machinery for manufacturing narrow-necked bottles.

Notes and Queries.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(9878) E. J. J. asks: 1. Will a storage battery made up of a bundle of thin lead plates separated by thin layers of asbestine paper be efficient? A. A storage cell can be made by the use of thin sheets of lead between sheets of asbestos. It would not be heavy enough to be efficient. This is the first way a storage cell was made—by rolling sheet lead between sheets of cloth. 2. What would be the surface required to give a current of 10 amperes? A. A storage cell may give 4 to 8 amperes per square foot of negative plates, counting both surfaces of the plate. 3. What would be the effect of using a stronger solution of sulphuric acid than 10 per cent? A. Too strong an electrolyte will consume the plates, and spend itself without giving any return. Sulphate of lead will be formed, and the plate will be destroyed.

(9879) F. E. W. writes: The statements and process of reasoning of your correspondent J. F. in Notes and Queries No. 9840 are so obviously and fundamentally erroneous, that I am surprised that you should print it without some editorial comment. To begin with, there is no such quantity in mechanics as "accelerating velocity." Perhaps J. F. intended to speak of *acceleration;* but if we grant that it was acceleration that was meant, then the dimensions in which it is expressed are wrong, for acceleration is not "feet per second," but *feet per second per second.* In fact, all through his argument J. F. has hopelessly confused the terms used in mechanics, and finally concluded by an attempt to subtract two forces from two accelerations—quantities which are as radically different in their nature as are volumes and areas. When we speak of a freely falling body, we do not mean one that is falling in air or other retarding media, but one that is acted upon by the force of gravity alone. It is only under this latter condition that a *constant* acceleration is given to such a falling body. To show that a ball of lead and one of cork will not reach the ground in the same time if they are dropped at the same instant, let us first see what kind of quantities we have to deal with in the solution of the problem. Without going too deeply into the question of dimensions, we define both weight and force as being the product of two factors, or

$$\text{Weight} = \text{Force} = \text{Mass} \times \text{Acceleration},$$

$$\text{and acceleration is} = \frac{\text{Velocity}}{\text{Time}}.$$

When a body is allowed to fall in a vacuum, it is acted upon by the force of gravity alone. This force is equal, by definition, to the product of the mass of the body by the acceleration therein produced, or

$$F = M \times A.$$

Now, suppose the same body to be allowed to fall in air. The resistance offered by the air to the passage of the body through it is a *force* (which we may call f) and acts in direct opposition to the force of gravity, so that the resultant force, acting downward on the body, is less than in the first case, and we may write:

$$(F - f) = M \times A'.$$

The left-hand member of this equation is obviously less than that of the preceding one, so therefore our right-hand member must also be less. But as the mass M is constant, the only factor that can have decreased is the acceleration, and therefore A' is less than A. This is the same thing as saying that gravity cannot accelerate a body so rapidly in a resisting medium as in a vacuum, a statement that ought to be self-evident. Let us consider now two balls of the same identical shape and size, but one weighing 40 pounds and the other 2 pounds. And suppose, for convenience, that each ball meets with a resistance of 1 pound when it is falling through the air at some uniform velocity $= v$, say. Then when the two balls are dropped in a vacuum, we have, by substitution in our first equation,

$40 = m_1 \times a_1$ for the heavy ball, and
$2 = m_2 \times a_2$ for the light ball.

The masses m_1 and m_2 being proportional to the weights of the balls, the accelerations a_1 and a_2 are equal to each other, and the balls fall in equal times.

Now, if dropped in air, when the balls are falling at the velocity v, we will have:

$(40 - 1) = m_1 \times a_1'$ for the heavy ball, and
$(2 - 1) = m_2 \times a_2'$ for the light ball.

From this we see that

$$a_1' = 39/40a_1 \text{ and } a_2' = 1/2a_2$$

Therefore the percentage decrease in the acceleration due to gravity is only 2½ per cent for the heavy ball, while for the light ball it is 50 per cent. Therefore the heavy ball is accelerated most, and falls the faster. It is thus clear that the retarding force of the air due to the passage of the balls through it, which is assumed to be the same on each ball, is not a quantity that can be subtracted from a velocity, as J. F. would have it, but one that enters the equations of motion in an entirely different way. A. There is perhaps no proper defense for having printed Query 9840 without a refuting comment, but it was done to show a type of reasoning which very often comes to our desk. Indeed, this matter of falling bodies retarded by the atmosphere is probably the most prolific in our correspondence, only a very small portion of which gets into print. The demonstration you give is probably quite too technical for the average reader of Notes and Queries, whom we are always obliged to keep in mind in deciding what to insert in the column. The new expression for acceleration, "feet per second per second," is correct, but in the editor's experience with classes it is in no way an improvement over the older mode of expressing the same fact, if indeed it is not really a block to understanding. To meet the needs of those whom we must keep in mind, who are not versed in mathematical mechanics, we must avoid the equation as much as possible, and make our explanations in words. This is not as satisfactory to the mathematician, of course, but we are confident that it meets the needs of our average reader.

(9880) J. R. W. asks: Please explain the following phenomena in the Notes and Queries department of the Scientific American: About four years ago, at 3 o'clock P. M., two friends and myself witnessed the falling of a meteor near Springfield, W. Va. The sun was shining and we were looking toward the east. A mountain about 1,000 feet higher than where we were standing lay one mile east of us. The meteor was brilliant red, and about the size of the planet Mercury. When first observed it seemed about 500 feet higher than the top of the mountain. It fell nearly vertical, and seemed to drop on the mountain about one-third way down from the top, and was so plain that we located where it seemed to fall, by a tree. On examining the place no trace of it could be found. A few days after I read an account of a large meteor falling in Clark County, Va., on the same day and hour. Do you think the meteor we saw was the same one that fell in Clark County? The distance is 40 to 50 miles. A. It is very easy to believe that the meteor described as seen above a mountain top was in reality 40 miles away. There is no possible way to estimate distances in the sky, in the line of sight. An error is most easily made in judging the distance of such an object.

(9881) M. L. C. asks: How could I arrange so that I would get electric sparks by sliding a silken cushion (or any other material) along a glass rod back and forth? A. It is not possible to obtain sufficient electrical energy by rubbing a glass rod with a rubber held in the hand to produce sparks. A plate swiftly rotated as in the various machines is needed. The best which can be done with a rod and rubber in the hand is to have the rubber of silk or woolen and lined with some strips of tinfoil connected to a wire which extends out so that the electricity which is generated may be conducted to the place where the spark is desired. Of course, the best way to get electric sparks is by the electrophorus. The making of this is easy. You can find out how to proceed by getting St. John's "How Two Boys Made Their Own Electrical Apparatus," a fine book which we send for $1.

(9882) W. E. B. asks: Please inform me, through Notes and Queries, what material is needed, and how to construct the so-called water-pail forge. A. The materials needed to construct a water-pail forge are a pail, some salt water, and some sheet lead. Place the sheet lead so as to nearly or quite cover the bottom of the pail, and have a strip extend up out of the salt water, so as to attach the positive wire to it. The negative wire is attached to the piece of metal to be heated, and the metal is dipped into the salt water. Instantly a flash of light occurs, and in a second or two it is white hot. The forge cannot be worked with much less than 220 volts.

(9883) J. W. asks: 1. What is the increase of velocity of a falling object per second? A. The velocity of a falling body increases 32.16 feet or 980 centimeters each second of its fall. 2. How long would it take an object to fall 3,000 feet? A. The time required to fall freely through any distance is found by the formula $S = \frac{1}{2}GT^2$. In this formula, $G = 32.16$; S is the space, and T is the required time. To solve your problem, put 3,000 feet as the S and solve for T. 3. What is the speed at which an object will take fire through friction with the air? A. The speed at which an object will take fire from friction against the air varies with the density of the air. It is not speed which determines the matter simply, but time which must be taken into account. See books of astronomy for this under meteors, since these take fire and shine by reason of the friction against the air as they fly swiftly through the air.

NEW BOOKS, ETC.

Modern Turbine Practice and Water-Power Plants. By John Wolf Thurston. New York: D. Van Nostrand Company, 1905. 8vo.; pp. 244. Price, $4.

Modern turbine practice is thoroughly described in this book, whose object is to give such information with regard to modern turbines and their proper installation as is necessary to the hydraulic engineer in designing a water-power plant, and no attempt has been made to treat the designing of turbines. The writer has designed turbines both in America and in Europe, and has been connected in engineering capacities with water-power developments aggregating nearly 200,000 horse-power, having been in charge of the hydraulic work during the planning and construction of some of the most important developments in Canada. He has had an excellent opportunity to study the subject from the point of view of the turbine builder and of the turbine user. In the first part of the book the author points out the direction in which improvement is to be sought in the present American turbine practice. On account of the great importance of the steam turbine and its close relation to the hydraulic turbine, the writer has included a chapter on this subject. It is an excellent work, and will prove of great value to the hydraulic engineer.

The Industrial Problem. By the Rev. Lyman Abbott. Philadelphia: George W. Jacobs & Co., 1905. 12mo.; pp. 196. Price, $1.

This book contains the lectures on Christian sociology given under the auspices of the Rev. William L. Bull Lectureship during the present year. The four lectures by Dr. Abbott are on the Industrial Problem; the Political Solution—Regulation; the Economic Solution—Reorganization; and the Ethical Solution—Regeneration. It is unnecessary to state that these lectures are in Dr. Abbott's most characteristic style, and that they contain much of interest on this, the greatest problem of our day.

Précis d'Hydraulique. La Houille Blanche. By Raymond Busquet. Paris: J. B. Baillière et Fils, 1905. 12mo.; pp. 317, 49 illustrations. Price, $1.50.

This work from the pen of Prof. Busquet has for its aim the placing at the disposal of all engineers, and others interested in the use of water power, of the principles to be followed in the construction of hydraulic power plants. M. Busquet first states the primordial laws of hydraulics which must be followed in plants of this character, and he then follows this with a discussion of the flow of liquids through pipes and in open canals. The latter part of the work describes various forms of turbines and waterwheels, and there is a closing chapter on the "Creation of a Water Power." The book, while more or less technical in character, does not go into mathematics beyond the solution of ordinary arithmetical problems, and the employment of the first principles of geometry.

Sugar and Sugar Cane. By Noël Deerr. Manchester, England: Norman Rodger, 1905. 8vo.; pp. 396. Price, $3.

The present work is an elementary treatise on the agriculture of sugar cane and on the manufacture of cane sugar. As there is no recent work in English covering the cane-sugar industry, the author hopes that this compilation may be of use to the English-speaking community connected with the industry. The book is a most comprehensive one, and will certainly be of the greatest possible value to growers, crushers, and refiners. It is a book which we can recommend.

Les Fours Electriques et Leurs Applications Industrielles. By Jean Escard. Preface by Henri Moissan. Paris: Vve. Ch. Dunod, Editeur, 1905. 8vo.; pp. 511. Price, $4.50.

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Sieve, Hoyt & Gaven 810,652
Sifter, flour, W. M. Viser 810,894
Signal lights, intensifying the colors of, W. Churchill 810,715
Signaling, W. Churchill 810,714
Skirt supporter, H. C. Deane 810,729
Smoke consumer, Fling & Nichols 810,741
Spacing mechanism, W. L. Haynes 810,648
Spatula and cork extractor, E. B. Jelks.......... 810,538
Spike, J. E. Pittman 810,808
Spinning or twisting machine thread guide mechanism, Green & Snelling 810,666
Spittoon, F. Reinschmidt 810,567
Stacking method and apparatus, straw, Gunn & McBride 810,485
Steam heater for warming and moistening foods, C. J. Monfort 810,496
Steam trap, T. Marcotte 810,423
Steel, hardening, R. A. Hadfield 810,531
Stereoscope, P. D. Fenn 810,401
Sterilizers, valve mechanism for, J. B. Hall 810,533
Stovepipe, Boyer & Peck 810,706
Strainer and cut-off, combined, A. W. Weber 810,515
Surgical table, J. L. Suddarth.......... 810,820
Surgical table, Dill & Du Bois.......... 810,848
Switch and signal track trip, C. M. Hurst. 810,868
Switch operating mechanism, G. Ward.......... 810,823
Tag, cattle, M. J. Bartlett.......... 810,386
Tank heater, gas burning, C. C. Fifield.......... 810,852
Telemeter, Joors & Mercenier 810,541
Telephone toll apparatus, G. A. Long.......... 810,491
Telephones and telegraphs, selective call for, W. Palmer, Jr. 810,878
Theatrical appliance, R. J. Fagan.......... 810,734
Thill coupling, J. A. McLaughlin.......... 810,552
Threshing machine, E. Kyllonen 810,774
Tin, making chlorin compounds of, C. E. Acker 810,456
Tire heating apparatus, G. W. Graves.......... 810,528
Tire, vehicle, C. Stein 810,888
Tobacco box, pocket, I. Z. Cohen.......... 810,720
Tongue switch, E. B. Prior.......... 810,433
Tool, pneumatic, W. R. Badger.......... 810,603
Train air pipes, coupling section for, W. J. Hofstatter 810,863
Trestle, H. M. Lay 810,776
Tripping apparatus, W. J. Newman.......... 810,555
Trousers press, M. H. Straus.......... 810,583
Truck, railway car, F. F. Shaffer.......... 810,815
Truck wheel, F. W. Stickle.......... 810,438
Tube. See Pile tube.
Tunnel shield, Parmelee & Williams.......... 810,428
Turbine, elastic fluid, P. C. Oscanyan.......... 810,607
Turpentine collecting spout, crude, J. I. Hatfield 810,752
Typewriter cabinet, Johnston & Watts.......... 810,416
Typewriting machine attachment, R. F. Elmberg 810,896
Valve, W. R. Whitehead 810,590
Valve, check, Nolan & Sanborn.......... 810,502
Valve, engine, G. Lane 810,422
Valve for compound air compressors, E. Hill 810,759
Valve for fluid compressors, discharge, W. Prellwitz 810,673

SENSITIVE LABORATORY BALANCE. By N. Monroe Hopkins. This "built-up" laboratory balance will weigh up to one pound and will turn with a quarter of a postage stamp. The balance can be made by any amateur skilled in the use of tools, and it will work as well as a $125 balance. The article is accompanied by detailed working drawings showing various stages of the work. This article is contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 1184. Price 10 cents. For sale by MUNN & CO., 361 Broadway, New York City, or any bookseller or newsdealer.

Valve for hoisting engines, reversing, J. L. Pilling	810,883
Valve for water gages, check, Hadley & Moylan	810,746
Vapor generator, A. Harrison	810,486
Vegetable disintegrator, N. J. Shimmel	810,816
Vegetable washer, L. Meyer	810,548
Vegetation destroyer, McKeen & Fetters	810,793
Vehicle, R. N. Marts	810,492
Vehicle attachment, H. F. Cook	810,722
Vehicle brake, J. L. Brewton	810,612
Vehicle, motor, L. S. Pfouts	810,881
Vehicle motor suspension mechanism, F. B. Rae	810,674
Vehicle steering device, G. K. Rudert	810,679
Vehicle steering mechanism, F. B. Rae	810,673
Vehicle weighing device, E. T. Zeidler	810,517
Vehicle wheel, T. Gare	810,526
Vehicles, hanging strap for passenger, J. S. Collins	810,395
Vending machine, coin-controlled, E. F. Spaulding	810,576
Vending machine, coin-controlled, Hall & MacLeod	810,747
Vinasses, treatment of, C. Sudre	810,442
Voltmeter switch, G. N. Eastman	810,522
Voting machine support, C. F. Harrington	810,645
Voucher for shipping vessels, F. A. Glidden	810,483
Wagon, W. Leppert	810,872
Wagon bolster, G. McMurtrie	810,500
Wagon box and hay rack lifter, M. J. Saagen	810,512
Wagon, dumping, G. R. Starnes	810,684
Warp twisting-in machine, A. Calleson, et al	810,711
Washing machine, A. L. Owens	810,427
Washing machine, A. G. Moeckel	810,549
Water escape, B. F. Perry	810,879
Water motor, R. K. Parkerson	810,507
Water wheel casings, cushion device for gates of, C. E. Parsons	810,803
Wedge, spring-jack, G. A. Zundel	810,596
Weighing machine, automatic, E. C. Arnett	810,694
Wheel, C. Heart	810,649
Wheel attachment, vehicle, G. W. Kirkpatrick … 810,419,	810,420
Window attachment, G. H. Faulkner	810,735
Window fixture, Cribbs & McCoy	810,469
Window frame, H. C. Smith	810,887
Window protector, G. Baier	810,604
Wire stretcher, B. Markey	810,659
Wire stretcher, C. E. Crosby	810,724
Wire stretcher, C. R. McPherson	810,795
Wire working tool, T. J. Baugh	810,837
Wrench, E. K. Ansorge	810,599
Wrench, P. Kones	810,657

DESIGNS.

Brooch or similar article, J. H. Crosby	37,790
Crumb tray, M. M. J. Rooney	37,795
Dish, cover, R. L. Johnson … 37,792,	37,793
Game board, F. J. Wolf	37,796
Plate, C. E. Ziegler	37,794
Spoon handle, G. P. Ittig	37,791

TRADE MARKS.

Ale, ginger, Luyties Brothers	49,158
Antiseptic, prophylactic disinfectants, and parasiticides, Colyticine Chemical Co.	49,147
Anvils, C. F. Boker	49,144
Asphalt mastic, Gabriel & Schall	49,014
Axes, hatchets, and adzes, Supplee Hardware Co.	49,167
Baking powder, S. W. Williams	49,088
Baling presses, hay, Sandwich Manufacturing Co.	49,165
Bedsteads, metal, Marion Iron and Brass Bed Co.	49,126
Boiler compounds, Geo. W. Lord Co.	49,073
Boots and shoes, leather, John W. Russ Co.	49,125
Boots and shoes, leather, Guthmann, Carpenter & Telling	49,151
Boots and shoes, leather, Hine & Lynch	49,153
Boots, leather, Bradley & Metcalf Co.	49,001
Boots, shoes, and slippers and leather therefor, leather, Packard & Field	49,127
Boots, shoes, and slippers and soles therefor, Morse & Rogers	49,161
Boxes, wooden, New England Box Co.	49,133
Brushes, leather, Rubber and Celluloid Harness Trimming Co.	49,131
Burial caskets and casket attachments, National Casket Co.	49,079
Candies, Hawley & Hoops	49,097
Candies of various flavors, small round, D. Auerbach & Sons	49,143
Candy, Murbach Co.	49,102
Candy, Bradley Smith & Co.	49,169
Canned fish, clams, and oysters, R. C. Williams & Co.	49,067
Cards, playing, New York Consolidated Card Co. … 49,103 to	49,111
Cards, playing, United States Playing Card Co. … 49,112 to	49,114
Cartridges, Winchester Repeating Arms Co.	49,175
Caskets, coffins, and fixtures therefor, National Casket Co.	49,162
Catarrh cure, F. J. Cheney	49,145
Cement, S. S. White Dental Manufacturing Co.	49,083
Cement, Portland, German-American Portland Cement Works	49,015
Cement, Portland, Dexter Portland Cement Co.	49,029
Chains, Diamond Chain and Manufacturing Co.	49,003
Chocolate, Knickerbocker Chocolate Co.	49,157
Chocolates, Van Emden Cocoa Co.	49,115
Cleaning and polishing preparations, metal and glass, Electro-Silicon Co.	49,035
Cleaning and renovating compounds, Columbia Refining Co.	49,028
Clocks, alarm, A. C. Becken	49,027
Cloths for ladies', men's, and children's wear, Griffon Co.	49,074
Coats and overcoats, men's and boys', Mayer, Schoner, Offner & Co.	49,054
Coffee, G. B. Farrington Co.	49,062
Coffee, Crescent Manufacturing Co.	49,068
Coffee, G. B. Farrington Co.	49,082
Coffee, roasted and ground, New Orleans Coffee Co.	49,057
Concrete building block-making machine, Cement Machinery Co. … 49,120,	49,121
Concrete washtrays, Economy Manufacturing Co.	49,071
Confectionery, chocolate, E. Greenfield's Son & Co.	49,095
Cotton duck, Mount Vernon-Woodberry Cotton Duck Co.	49,044
Cotton piece goods, C. Whitman & Co.	49,065
Cotton piece goods, Massachusetts Cotton Mills	49,077
Cotton piece goods, M. I. Cooley	49,148
Cough drops, A. D. Work	49,116
Crochet quilts, Union Manufacturing Co.	49,063
Dental purposes, rubber for, Traun Rubber Co.	49,136
Dental varnish, S. S. White Dental Manufacturing Co.	49,134
Dyes and dyestuffs, Johnson-Richardson Co.	49,101
Electrical appliances, Hart Manufacturing Co.	49,100
Engines, gas or gasolene, Detroit Auto-Marine Co.	49,069
Fabrics, mercerized cotton, C. Whitman & Co.	49,064
Fish, dried, smoked, pickled, salted, and canned, W. T. Shute … 49,058 to	49,060
Gelatin, M. Michaelis & Son	49,055
Gin, National Distilling Co.	49,018
Glassware, cut, O. F. Egginton Co.	49,036
Gloves, Abraham & Straus	49,040
Gloves, Fownes Brothers & Co.	49,094
Hair drying powder, Waldeyer & Betts	49,085
Harness, saddles, collars, and bridles, Paducah Saddlery Co.	49,128
Harrows and cultivators, Atlanta Agricultural Works	49,142
Hatchets, axes, and adzes, James C. Lindsay Hardware Co.	49,155
Hats for women, J. L. Rosenberg	49,046
Heaters and radiators, steam and hot water, Gurney Heater Manufacturing Co.	49,150
Horse clippers, Chicago Flexible Shaft Co.	49,092
Insulating tape, Standard Paint Co.	49,172
Lamps, incandescent electric, Columbia Incandescent Lamp Co.	49,034

Lard and lard compound, Cudahy Packing Co.	49,170
Lathes, S. S. White Dental Manufacturing Co.	49,084
Leather, harness and saddlery, W. W. Mooney & Sons ...49,138, 49,176,	49,177
Leather, stuffing for, W. L. Alexander	49,026
Liniment, Dr. S. I. Tobias	49,135
Lithographs, art, Raphael Tuck & Sons Co.	49,130
Medicinal use, soluble thiosinamine compound for, E. Merck	49,160
Medicine, A. H. Keller	49,098
Medicine, alterative, Billings Clapp Co.	49,118
Medicine, proprietary, Dr. Kilmer & Co.	49,156
Milk, condensed, St. Charles Condensing Co.	49,081
Mineral water, natural, Manitou Mineral Springs Co.	49,171
Molasses, McCann & Co.	49,078
Mucilages, Carter's Ink Co.	49,033
Mustard and spices, Brownell & Field Co.	49,067
Nails, wire, C. F. Baker & Co.	49,060
Newspaper, weekly, C. Guild & Co.	49,133
Nippers, pincers, and cutting pliers, Utica Drop Forge & Tool Co.	49,173
Oil, cod liver, Waterbury Chemical Co.	49,086
Oil, olive, Marchesini Bros.	49,076
Overalls and workmen's shirts, coats or jackets, and pants, H. S. Peters	49,045
Packing, steam and water, American Steam Packing Co.	49,141
Paints, pigments for, Krebs Pigment and Chemical Co.	49,031
Paper, bond, W. E. Wroe & Co.	49,174
Paper clips, Cushman & Denison Manufacturing Co.	49,132
Pencils, lead, Eagle Pencil Co.	49,122
Pianos, H. Worch	49,039
Pigment colors and colored paints, J. T. Lewis & Bros. Co.	49,041
Pills, F. J. Cheney	49,146
Powders for cleaning solid and plated wares and metals, C. A. Everett	49,030
Printing and dyeing, manufactured colors for, American Dyewood Co.	49,140
Railway track bolts, American Iron and Steel Manufacturing Co.	49,089
Razors, G. R. Springer	49,166
Remedy for blood and nerve diseases, P. R. Palethorpe	49,120
Remedy for certain named diseases, W. R. Warner & Co.	49,137
Remedy for certain named diseases, X-Zalia Corporation	49,178
Remedy for diseases peculiar to women, proprietary, French Drug Co.	49,072
Rivet and screw bolts, American Iron and Steel Manufacturing Co.	49,117
Rubber heels and soles, Massachusetts Chemical Co.	49,159
Sheetings and drillings, G. L. Montgomery	49,056
Shirts and dress shirts, outer, Cluett, Peabody & Co.	49,050
Shoes, leather, J. P. Harray Shoe Co.	49,124
Shovels, scoops, and spades, steel, Avery Stamping Co.	49,168
Silk floss or embroidery silk, Incorporated New London Wash Silk Co.	49,053
Silks, Henry E. Frankenberg Co.	49,052
Soap, cake, A. Kilpstein & Co.	49,025
Soaps, fluid, A. Wood	49,038
Spices, E. B. Millar & Co.	49,070
Steel, Park Steel Co. ...49,163,	49,164
Sugar, Boston Molasses Co.	49,068
Suspenders, Morris Bros.	49,043
Tea, Sherman Bros. & Co.	49,080
Threads, chenille, and arrasene, Henry E. Frankenberg Co.	49,051
Tobacco, chewing and smoking, Bloch Bros. Tobacco Co.	49,061
Toilet powder, Byron C. Gould	49,119
Tonic, malt, Independent Brewing Ass'n	49,154
Varnishes and japans, Mayer & Loewenstein	49,042
Vermifuge, B. A. Fahnestock Co.	49,149
Veterinary remedy, O. O. Hattervig	49,096
Wagons, Moline Wagon Co.	49,099
Washboards, B. S. Jenkins	49,075
Whiskies, both rye and Bourbon, B. J. Semmes & Co.	49,021
Whisky, S. Altmayer	49,010
Whisky, Blumenthal & Hellbronner	49,011
Whisky, Brown-Forman Co.	49,012
Whisky, P. Freiler	49,013
Whisky, Mitchell, Fletcher & Co.	49,016
Whisky, M. Shaughnessy Distilling Co.	49,017
Whisky, A. E. Norris	49,019
Whisky, Rosskam, Gerstley & Co.	49,020
Whisky, D. Wise ...49,022,	49,023
Whisky, Wright & Taylor	49,024
Whisky, C. Sandheger	49,032
Whisky, Star Distillery Co.	49,037
Whisky, H. Swartz & Co.	49,047
Whisky, Star Distillery Co.	49,048
Whisky, D. Wise	49,049
Wire ropes, A. Leschen & Sons Rope Co.	49,139

LABELS

"Almond Cold Cream, La Favorita," for cold cream, Jacobus Pharmacal Co.	12,631
"Ambrosia Angel's Food Sweet Vanilla Chocolate," for chocolate, Ambrosia Chocolate Co.	12,621
"Ambrosia Pure Cocoa," for cocoa, Ambrosia Chocolate Co.	12,622
"Ambrosia Sweet Chocolate," for chocolate, Ambrosia Chocolate Co.	12,620
"Blue Wing Rye Whiskey," for rye whisky, C. H. Wittenberg Distilling Co.	12,626
"Body Builders," for medicine, Body Builders Medicine Co.	12,618
"Capilerba," for hair restorative, C. J. Hugel	12,615
"El Sazonado," for cigars, A. C. Henschel & Co.	12,619
"Frost King Whiskey," for whisky, Kamp Distilling Co.	12,627
"Hydrarg-Iodo-Nucleoid," for medicine, Dinet & Delfosse Pharmacal Co.	12,617
"Hydrarg-Nucleoid," for medicine, Dinet & Delfosse Pharmacal Co.	12,616
"Kar-a-Van," for coffee, Gasser Coffee Co. ...12,623,	12,624
"McTague's Shell Fish Chili Sauce," for chili sauce, Triumph Catsup and Pickle Co.	12,629
"Old Ben Franklin," for coffee, H. H. Palmer	12,625
"Outing Brand California Peaches," for California peaches, Castle Brothers	12,630
"Rattle-snake Oil Liniment," for a liniment, Masons Medical Co.	12,614
"Seroco Whiskey," for whisky, W. V. Wexberg	12,628
"Tubs," for pulverized scouring soap, M. H. Fairchild & Bro.	12,632

PRINTS.

"Ayer's Cherry Dentifrice," for cherry dentifrice, Ayer Medical Co.	1,562
"Mill Work," for wood millwork articles, J. L. Walpole	1,565
"Mrs. Hord's Colonial Pickle," for pickle, A. G. Hord	1,563
"The Sign of the Good Glove," for gloves and mittens, Joseph N. Eisendrath Co.	1,564

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., 361 Broadway, New York.

NOTICE TO CONTRACTORS.

SEALED PROPOSALS suitably endorsed on envelope for Refrigerating Apparatus, Hudson River State Hospital, Poughkeepsie, N. Y., will be received up to three o'clock P. M., on Wednesday the seventh day of February, 1906, by the State Commission in Lunacy, at the Capitol, Albany, N. Y., when the bids will be opened and read publicly.

Drawings and specifications may be consulted and blank forms of proposal obtained at Hudson River State Hospital, Poughkeepsie, N. Y., or by application to G. L. Heins, State Architect, in the Capitol, at Albany, N. Y.

Contracts will be awarded to the lowest responsible and reliable bidders unless the bids exceed the amount of funds available therefor, in which case the right to reject all bids is reserved.

T. E. McGARR,
Secretary,
State Commission in Lunacy

Dated, Albany, N. Y.,
Jan. 22, 1906.

PROPOSALS will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until 10 o'clock A. M., February 20, 1906, and publicly opened immediately thereafter, to furnish at the Navy Yard, New York, N. Y., a quantity of machine tools, etc., comprising saw bench, planer, tubular boiler, pumps, and steam winches. Applications for proposals should refer to Schedule 343. Blank proposals will be furnished upon application to the Navy Pay Office, New York, N. Y., or to the Bureau. H. T. B. HARRIS, Paymaster-General, U. S. N. 1-27-06.